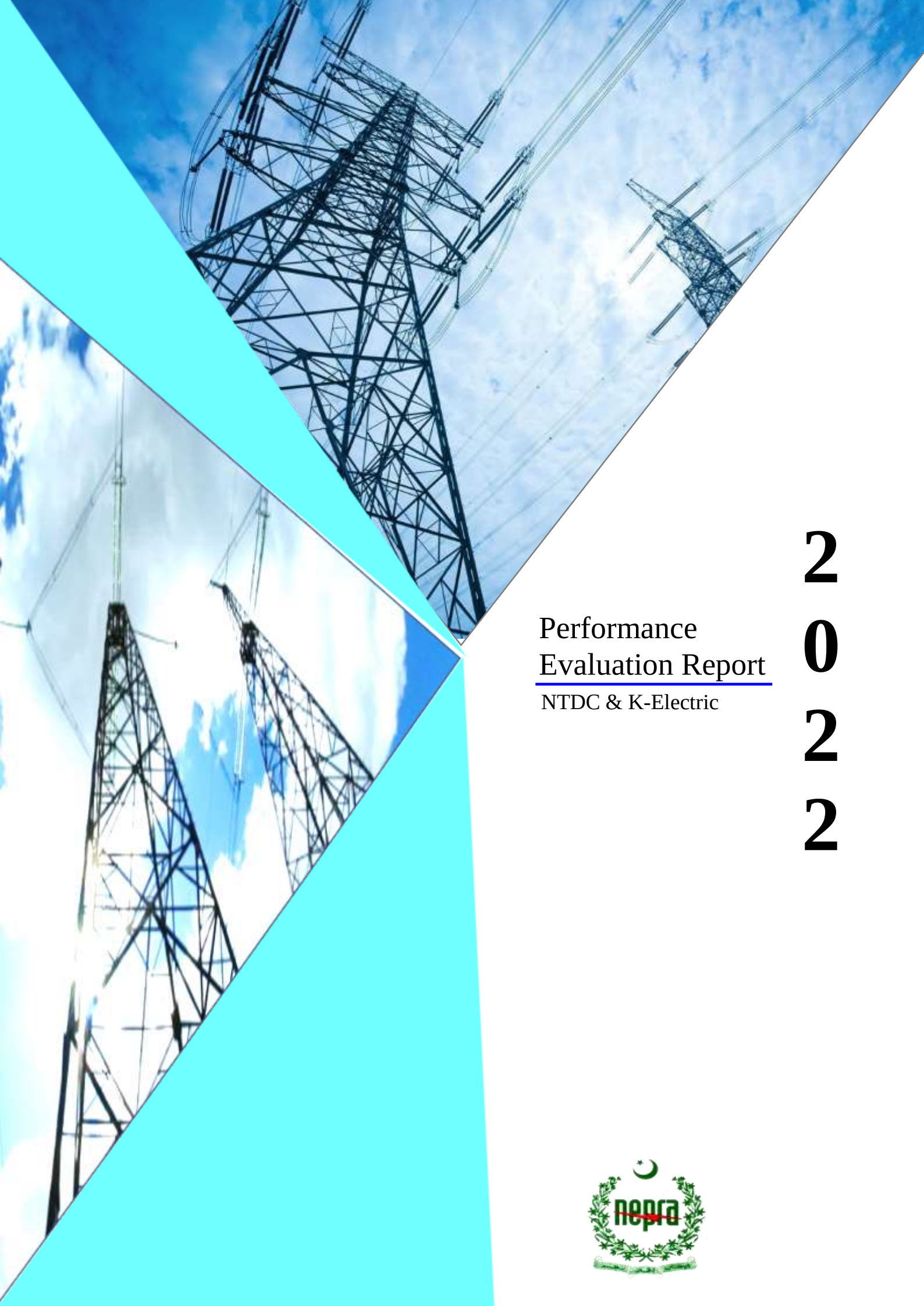

Performance Evaluation Report

NTDC & K-Electric

2022

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The National Electric Power Regulatory Authority (NEPRA) is the regulator of the power sector in Pakistan. Provision of safe, reliable, efficient and affordable electric power to the electricity consumers is an integral part of NEPRA's regulatory regime.

In order to ensure safe, efficient and reliable transmission services, NEPRA has framed the Performance Standards (Transmission) Rules (PSTR)[1] 2005. Under PSTR, a transmission licensee is required to submit to NEPRA an Annual Performance Report (APR) in a manner as prescribed in PSTR. The APRs for the FY 2021-22, submitted by NTDC and K-Electric were reviewed and analyzed in light of the performance parameters such as system duration of interruption, system frequency of interruption, energy not served (ENS), loss of supply incidents along with its financial impact, amount allowed for improvement, voltage and frequency violation limits prescribed under the PSTR, and highest and lowest voltage recorded at NTDC 500 kV and 220 kV grid stations under Normal system conditions. Highlights of the analysis/findings are given in succeeding paras.

PERFORMANCE OF NTDC

System Duration of Interruption

System duration of interruption is a reliability indicator that measures the average outage duration that an Interconnection point observes in a year. The interruption was witnessed around 0.15 hours (9 minutes) in the year 2021-22 indicating 15.4% increase as compared to preceding year i.e. 0.13 hours.

System Frequency of Interruption

System frequency of interruption is a reliability parameter that measures the average number of outages per circuit in a year. During 2021-22 the average number of outages per circuit for NTDC remained 0.10, showing an improvement of 10% over the previous year i.e. 0.11.

Energy Not Served (ENS)

In order to gauge system security, the estimates of total ENS during the year as reported by the licensees have been analyzed. The total ENS as reported by NTDC in 2021-22 is **9.4 million kWh** that indicates around 93% improvement over the previous year i.e. 130.2 million kWh. Based on the average sale rate of DISCOs[2], the financial impact amounts to around **Rs. 93 million**.

Loss of Supply Incidents

NTDC reported 51 loss of supply incidents during the year 2021-22 which translates into total duration of 80 hours. The detail of average ENS per incident along with duration and subsequent financial impact for the last five years is given in section 3.2 of this report. As reported by NTDC, these outages include 3 major disturbances that accounts for an outage of around 3 hours and ENS of 4.62 million kWh. Around 50% of financial impact as indicated above is attributed to these 3 major incidents which is undesirable. NEPRA took serious notice of the partial collapses and the reports submitted by NTDC revealed serious lapses on the part of NTDC. Based on the reports, NEPRA initiated legal proceedings and imposed a fine of Rs. 10 Million on NTDC.

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[1] Under section 46 of the Regulation of Generation, Transmission and Distribution of Electric Power Act 1997 (XL of 1997), read with section 7 (2) (c) and section 34 thereof, the National Electric Power Regulatory Authority, with the approval of Federal Government, has made the Performance Standards (Transmission) Rules (PSTR) notified vide S.R.O 1138(I)/2005 dated 15th November, 2005.

[2] DISCOs Average Energy Sale Rate = Rs. 9.8680/kWh.

It was also observed that after the blackout of 9th January 2021, NTDC was directed to make certain improvements in its transmission network for the improvement of system reliability, stability and security of supply. However, recent events and multiple outages in NTDC's network during the FY 2021-22 indicates that adequate measures have not been taken by NTDC in this regard.

Transmission network being the backbone of the country's electric power supply system, the Authority allowed a colossal amount of Rs. 790 million to NTDC under the head of repair & maintenance (R&M) to ensure and attain optimal level of network reliability and sustainability. However, the monitoring activities such as field visits and checks carried out by NEPRA during the period reveal that southern part of the network is vulnerable to frequent outages that lead to major system disturbances owing to aging of equipment and tower collapses.

Voltage Violations

NEPRA PSTR prescribes limits for voltage variations. Number of voltage violations for NTDC remained 185,497 for the year 2021-22 that indicate 54.5% increase as compared to 120,092 violations in the preceding year.

Highest and Lowest Voltage Recorded Under Normal System Condition

The highest voltage recorded beyond permissible limits at 500 kV voltage class was 564 kV, recorded at D. G. Khan. The voltage of 564 kV shows approximately 7.4% variation with respect to allowed limit (±5% = 525/475 kV). Similarly, at 220 kV level, highest voltage was 250 kV recorded at Muzaffargarh. Voltage of 250 kV indicates approximately 8.2% variation with respect to allowed limit (+5% = 231 kV).

Similarly at 220 kV level, the voltage remained as low as 150 kV, recorded at Kala Shah Kaku and 170 kV at Quetta that indicates 28.2% & 18.7% variation with respect to allowed limit (-5% = 209 kV) respectively which may affect the consumer end voltages and consequently equipment damage.

In order to diagnose the root cause of low voltage, monitoring activities are carried out by NEPRA on regular basis to avoid any undesirable condition on the system and ensure continuity and stability of supply to the electricity consumers of Pakistan.

Frequency Violations

NEPRA has prescribed limits for frequency variations under the Rules. The frequency data as reported by NTDC indicated variation in frequency limits beyond the upper permissible limit of 50.5 Hz and highest frequency recorded was 50.66 Hz that comes out to be 1.3% variation against the allowed limit of 1% in the year 2021-22. However, NTDC has violated the prescribed limits 4 times for a total of 26 minutes.

SCADA System

The complexity of the modern day power systems require automation for real time data acquisition enabling quick and intelligent decisions for supervision, monitoring and control of the transmission system. NEPRA has long been emphasizing a need to deploy modern SCADA System by NTDC to supervise and control the economic despatch of electric power generation which has still not turned up. The Authority has allowed Rs. 3400 million to NTDC in the last three years for installation and commissioning of SCADA system and services as per request of NTDC which is not been in field yet.

System Constraints and Overloading of Transmission Network

Over the years NTDC has been reporting constraints in transmission system as one of the major causes of under-utilization of efficient power plants. During the reported period, at several instances, the transmission system remained incapable to transmit the electric power from efficient power plants to load centers to meet the demand. NTDC is still requiring a longer period to fix the existing constraints which are causing the operation of power plants in violation of EMO. NTDC needs to take measures/steps to remove constraints in its network to off-take electric power from existing power plants as well as upcoming power projects in light of the Transmission System Expansion Plan (TSEP) duly integrated with the plan for induction of new generation plants in accordance with Indicative Generation Capacity Expansion Plan (IGCEP).

Similarly, the data pertaining to system constraints revealed that most of the grid stations are overloaded. It is noteworthy to mention that NEPRA has allowed a substantial amount to NTDC for removal of system constraints that has a considerable financial impact on account of operation of expensive plants due to transmission system constraints. NTDC's progress on removal of system constraints is slow and around 11 projects are delayed as highlighted in section 3.3.1 of this report. NTDC needs to complete it on priority to avoid any adverse impacts on the power sector.

Interconnection Facilities for New Power Plants

In various cases, NTDC could not be able to complete the interconnection facilities for evacuation of power from new power plants as per the approved design and within the stipulated time period and thus caused under-utilization of the available capacity. It has also been observed that progress on evacuation projects is slow due to which cheap electricity located in Thar is compromised. Such as the absence of dedicated transmission line for Shanghai Electric Company Limited (SECL) plant, leads to load curtailment of Engro Power Thar Limited (EPTL) and Thar Energy Limited (TEL) due to inadequate transmission capacity. NTDC needs to complete its evacuations projects on priority so that any adverse impact on the power sector may be avoided.

PERFORMANCE OF K-ELECTRIC

System Duration of Interruption

System duration of interruption was witnessed as 0 Hours which shows 100% reduction as compared to preceding year's average of 0.06 Hours (4 minutes).

System Frequency of Interruption

System frequency of interruption was observed as 0 number of outages per circuit. It indicates a decrease of 100% over the previous year i.e. 0.02.

Energy Not Served (ENS)

In order to gauge system security, the estimates of total energy not served (ENS) during the reported period has been analyzed. The total ENS as reported by KE is zero.

Voltage Violations

KE has reported 46 voltage violations under normal condition that indicates 100% increase with respect to preceding year.

System Frequency

During 2021-22, only 1 time frequency remained outside the prescribed limit (upper) i.e. 50.53 Hz for 9 minutes and that comes out to be approximately 0.002% of the reported period.

It is pertinent to highlight that during the reported period two partial collapses occurred and KE's system collapsed as well that nullifies its stance of zero outages. Furthermore, it is important to highlight that KE being a vertically integrated utility having a generation fleet of around 2,817 MW has failed to survive during major incidents repeatedly which is a matter of serious concern.

In order to improve the performance of the licensees, the measures/steps in forthcoming paras may be taken.

The equipment which have exhausted their useful life should be replaced with new one at all the grid stations on as and when required basis. The volume of power being evacuated in south especially at 500 kV Jamshoro has enormously increased in recent years due to thermal, nuclear and wind generation addition. This has resulted in increased short circuit fault level at 500 kV Jamshoro. Therefore, short circuit studies shall be carried out at aforesaid grid in particular and all other grids in general to determine the actual fault level for proper primary equipment selection/installation.

Event fault recorders shall be installed for better fault analysis to avoid outages. Behavior of bus-bar protection relays shall be reviewed and tested thoroughly. NTDC shall complete the system constraints removal projects to eradicate the financial impact caused due to merit order violation on account of system constraints and power evacuation projects to bring in most economical power into the national grid at the earliest.

To avoid the unnecessary loss due to its network shortcomings, adversely affecting the end-consumer, NTDC needs to strengthen its planning process on two prongs; first to remove system constraints for uninterrupted evacuation of power from existing power plants located across the country and its transmission to load centers and secondly to expand its network to make the interconnection facilities ready for evacuation of electric power from upcoming projects within the stipulated time period.

KE being the responsible entity for providing reliable power to its consumers and especially the city of Karachi being the economic hub of the country, it is of paramount importance to take measures/steps to operate in island mode in the event of external major incidents to avoid unnecessary power cuts.

Moreover, NEPRA is taking appropriate actions against the violations as highlighted in this performance evaluation report in accordance with law.

INTRODUCTION

1 Introduction

This Performance Evaluation Report (PER) provides information on the performance of the transmission licensees i.e. National Transmission & Despatch Company (NTDC) and K-Electric (KE) as per National Electric Power Regulatory Authority (NEPRA) Performance Standards (Transmission) Rules (PSTR) 2005, based on their reported data for the year 2020-21.

The document, further, takes account of system reliability, security of supply and quality of supply of the transmission network of the licensees during the reported period. Trend analysis in terms of comparison over the last five years has also been provided in this regard.

1.1 Reporting Requirement

Pursuant to Rule 9 of the PSTR, the licensee shall submit to the Authority every year, before the 31st of August of the succeeding year, an Annual Performance Report (APR). The APR shall contain all relevant information with respect to compliance with these rules during the year, including a statement of comparison with the compliance reporting achieved during the preceding year. The reporting guidelines are provided under Rule 10 of PSTR 2005.

1.2 Compliance

Pursuant to Rule 6 of PSTR 2005, the quality of supply shall be measured with reference to system voltage and system frequency. The system voltage and frequency requirements are provided in Rule 7 and 8 of PSTR 2005 which are as follows:

Rule 7 of PSTR 2005 (System Voltage)

1) Under normal conditions the voltage variations of plus or minus ±5% of the nominal voltage for voltages of 132kV (where applicable) and above shall be permitted.

2) Under (N-1) contingency conditions voltage variations of plus or minus ±10% of the nominal voltage for voltages of the 132kV (where applicable) and above shall be permitted.

3) The criteria for reporting voltage variations outside the limits specified in sub-rules (2) and (3) only apply when the duration of variation exceeds a continuous period of thirty (30) minutes.

Rule 8 of PSTR 2005 (System Frequency)

1) The frequency variations of plus or minus ±1% of the nominal frequency of 50 Hertz shall be permitted, i.e. frequency to remain within the frequency limits of 49.50 to 50.50 Hertz at all times.

2) The criteria for reporting frequency variations outside the limits specified in sub-rule (1) only apply when the duration of the variation exceeds a continuous period of five (5) minutes.

N T D C

2 Brief about NTDC

NTDC was incorporated under the Companies Ordinance 1984 on November 6, 1998 as a result of structural reforms introduced by the Government of Pakistan in the Power Sector. The principal business of NTDC is to own, operate and build infrastructure for transmission system of 220 kV, 500 kV and above transmission Lines and associated Sub-stations.

NTDC commenced its commercial operation on 1st of March 1999 and was organized to take over the properties, assets, rights, obligations and liabilities of transmission network all over Pakistan previously owned by Pakistan Water and Power Development Authority (WAPDA), except the area served by K-Electric.

2.1 Licence

NTDC was granted Transmission Licence on 31st December 2002 by NEPRA to engage exclusively in the transmission business for a term of thirty (30) years, pursuant to Section 17 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

2.2 Transmission Network

NTDC operates & maintains seventeen (17) 500 kV and forty-seven (47) 220 kV Grid Stations with 8,387 km of 500 kV and 11,611 km of 220 kV transmission lines as of June, 2022. Figure 2.1 shows detail of NTDC transmission system.

Figure 2.1: NTDC transmission system

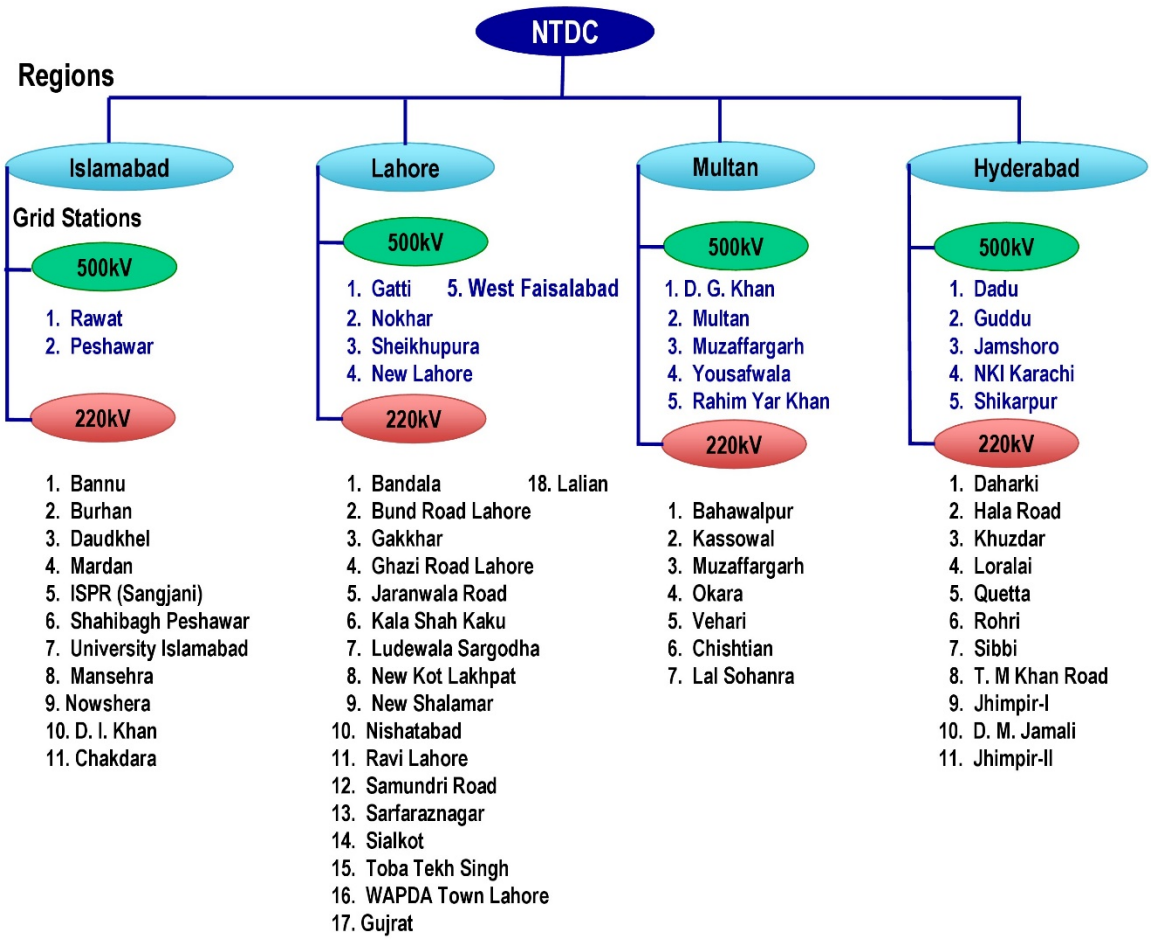


Table 2.1: NTDC Network Statistics

Description		2017-18	2018-19	2019-20	2020-21	2021-22
No. of Grid Stations	500 kV	16	16	16	16	17
	220 kV	40	44	45	45	47
	Total	**56**	**60**	**61**	**61**	**64**
Length of Transmission Line (Circuit km)	500 kV	5,772	5,970	7,470	8,059	8,387
	220 kV	10,753	11,322	11,281	11,438	11,611
	Total	**16,525**	**17,292**	**18,751**	**19,497**	**19,998**
Transformation Capacity (MVA)	500 kV	20,850	22,350	24,000	30,610	32,700
	220 kV	28,610	31,060	31,900	25,770	28,160
	Total	**49,460**	**53,410**	**55,900**	**56,380**	**60,860**

2.3 Performance at a Glance

An overview of the performance of NTDC is given hereunder in light of the reported data;

System Reliability

Average Duration of Interruption

1. Total outages hours recorded at all interconnection points (excluding 132 kV line tripping) = **79.7 Hrs**
2. Total number of interconnection points = **532**
3. System duration of interruption = **0.15 Hrs/point** i.e. **9 min.**

15.4% increase with respect to previous year i.e. 0.13 Hrs/point

Average Frequency of Interruption

1. Total number of outages recorded at all 132 kV outgoing circuits (excluding 132 kV line tripping) = **51**
2. Total number of 132 kV circuits = **532**
3. System frequency of interruption = **0.10 Nos./circuit.**

10% improvement over the previous year i.e. 0.11 Nos./circuit

System Security

Energy Not Served (ENS)

1. Total ENS = **9.4 Million kWh**
2. Number of incidents, where there has been a loss of supply = **51**
3. Average ENS per incident = **0.2 Million kWh**
4. Average duration per incident = **1.6 Hrs (1 Hr & 36 min)**
5. Financial impact of ENS = **Rs. 93 Million**
6. Financial impact per incident = **Rs. 1.8 Million.**

ENS of 9.4 Million kWh indicates around 93% improvement the previous year i.e. 130.2 Million kWh.

Rs. 93 Million indicates around 90% decrease than the previous year's impact of Rs. 888 Million.

Quality of Supply

Voltage

1. Total number of violations under Normal condition = **180,097**
2. Total number of violations under N-1 condition = **5,400**
3. Total number of violations under Normal & N-1 condition = **185,497**
4. Highest voltage recorded under normal conditions; @500 kV level: **564 kV** at D.G Khan; @220kV level: **250 kV** at Muzaffargarh.
5. Lowest voltage recorded under normal conditions; @220kV level: **150 kV** at **Kala Shah Kaku** & **170 kV** at **Quetta**.

Violations of 185,497, indicates 54.5% increase over the previous year's 120,092.

Frequency

1. Number of times frequency remained outside the limits in a year = **3**
2. Time duration the frequency remained outside the limits in a year = **26 min.**
3. %age time of the year the frequency remained outside the limits = **0.005% time of the year.**
4. Highest frequency recorded = **50.66 Hz**
5. No violation at lower end.

Allowable limits: 49.5 Hz – 50.5 Hz

3 Analysis of NTDC's Annual Performance Report (APR)

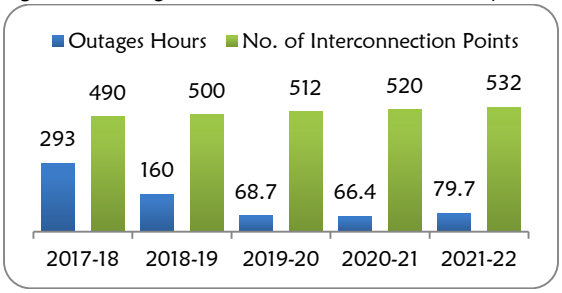
The Annual Performance Report submitted by NTDC has been analyzed in light of the PSTR 2005. The detail is given hereunder;

3.1 System Reliability

3.1.1 System Duration of Interruption

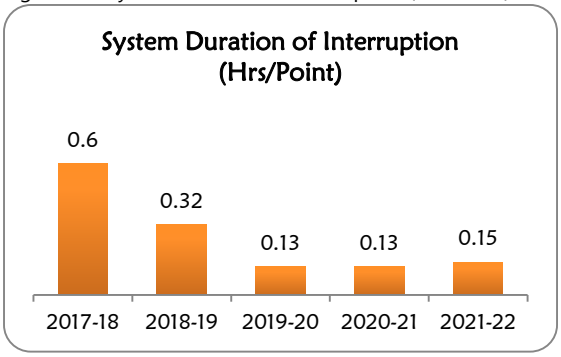
The total outages hours recorded at all interconnection points are 79.7 during the reported period, indicating a 20% increase in comparison to the preceding year's 66.4 hours. Similarly, 12 number of interconnection points have been added to the system resulting into 532 in total. The same has been shown in figure 3.1.

Figure 3.1: Outages hours & No. of interconnection points



The average duration of interruption per interconnection point during the reported period remained 0.13 hours (8 minutes). This indicates that NTDC has maintained status quo position. The same has been shown in figure 3.2.

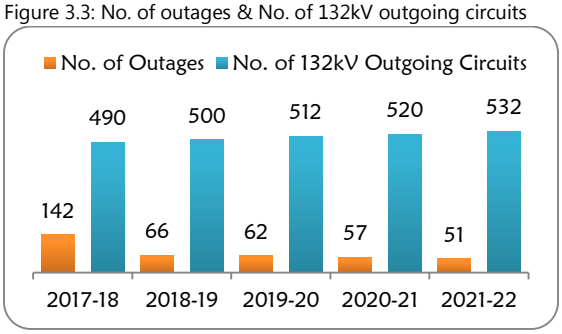
Figure 3.2: System duration of interruption (Hrs/Point)



3.1.2 System Frequency of Interruption

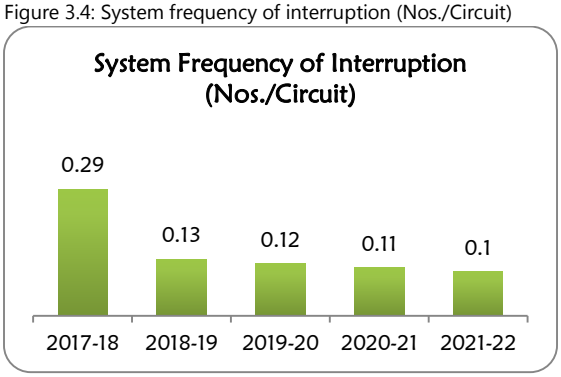
The total number of outages remained 51 in the year 2021-22 that shows a reduction of around 10% as compared to preceding year's 57 outages as shown in the flowing figure.

Figure 3.3: No. of outages & No. of 132kV outgoing circuits



Average number of interruptions per circuit during the reported period remained 0.10 indicating 10% improvement in comparison to the preceding year's 0.11 as shown in figure 3.4.

Figure 3.4: System frequency of interruption (Nos./Circuit)



3.2 System Security

In order to gauge system security, the estimates of total energy not served (ENS) during the reported period has been analyzed. The total ENS as reported by NTDC is 9.4 million kWh. Based on the average energy sale rate of DSICOs[3], the financial impact of 9.4 million kWh, amounts to approximately Rs. 93 million. The detail is given hereunder;

Figure 3.5: Reported ENS

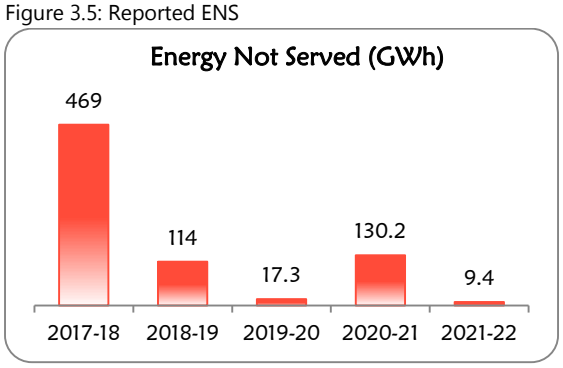


Figure 3.6: Loss of supply incidents & duration per incident

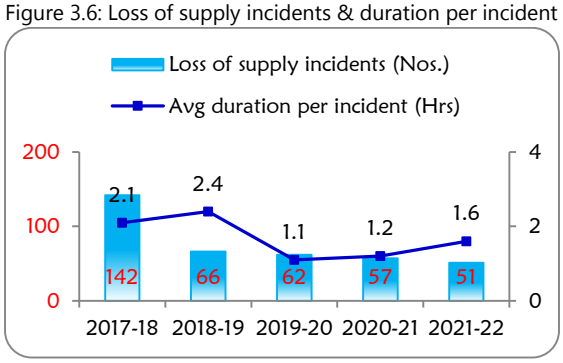


Figure 3.7: Loss of supply incidents along with average

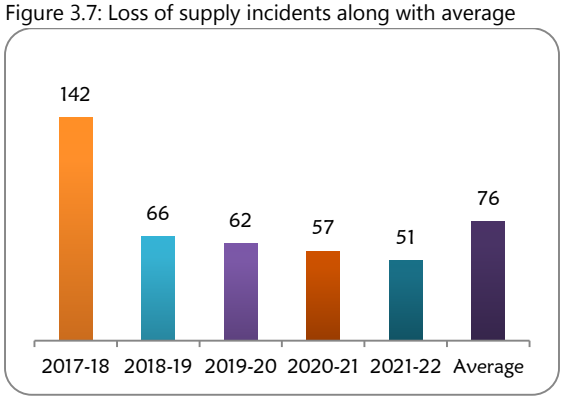


Figure 3.8: Region wise loss of supply incidents

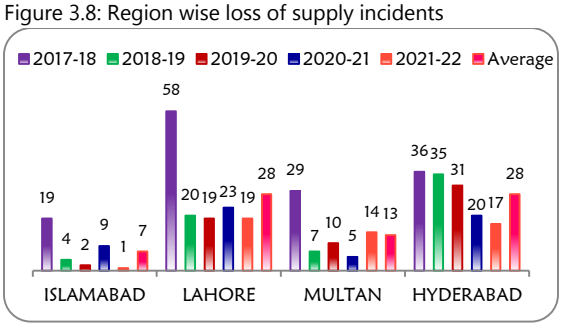
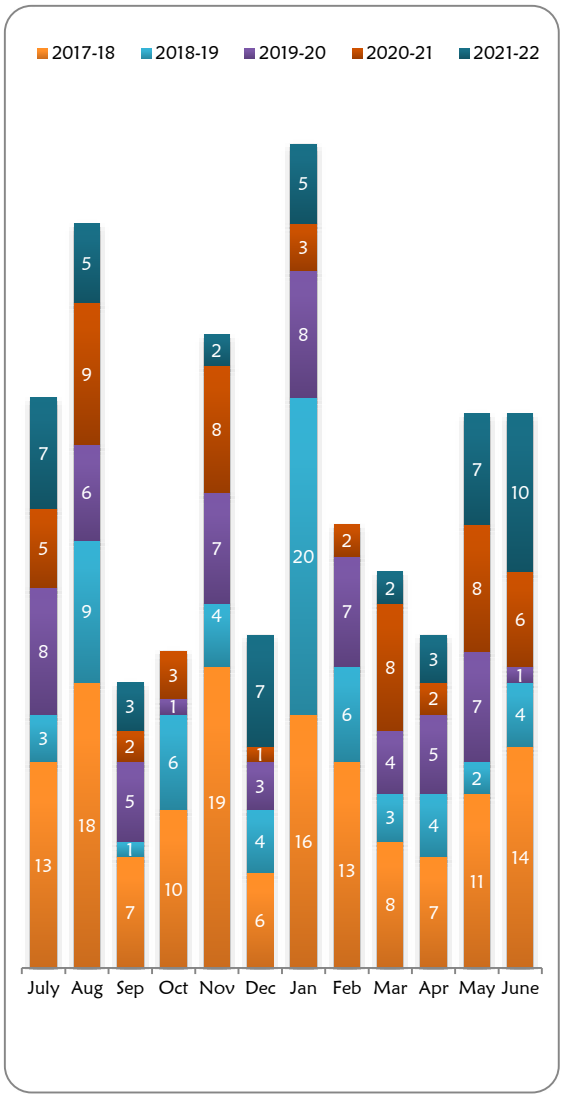


Figure 3.9: Seasonal trend of loss of supply incidents



[3] DISCOs Average Energy Sale Rate = Rs. 9.8680/kWh.

Table 3.1: Loss of supply incidents, average ENS, duration & financial impact per incident

▼ Description / Unit / Year ►	Unit	2017-18	2018-19	2019-20	2020-21	2021-22
Loss of Supply Incidents	Nos.	142	66	62	57	51
Average ENS per Incident	Million kWh	3.3	1.7	0.3	2.3	0.2
Average Duration per Incident	Hrs : Min	02 : 06	02 : 24	01 : 06	01 : 12	01 : 36
Financial Impact per Incident	Rs. (Million)	17.5	9.7	1.4	15.6	1.8

3.2.1 Major System Disturbances

As reported by NTDC, these outages include 3 major disturbances in FY 2021-22 that accounts for an outage of around 3 hours and ENS of 4.62 million kWh. Around 50% of financial impact is attributed to these 3 major incidents which is undesirable. The detail is summarized below: -

Table 3.2: Major system disturbances

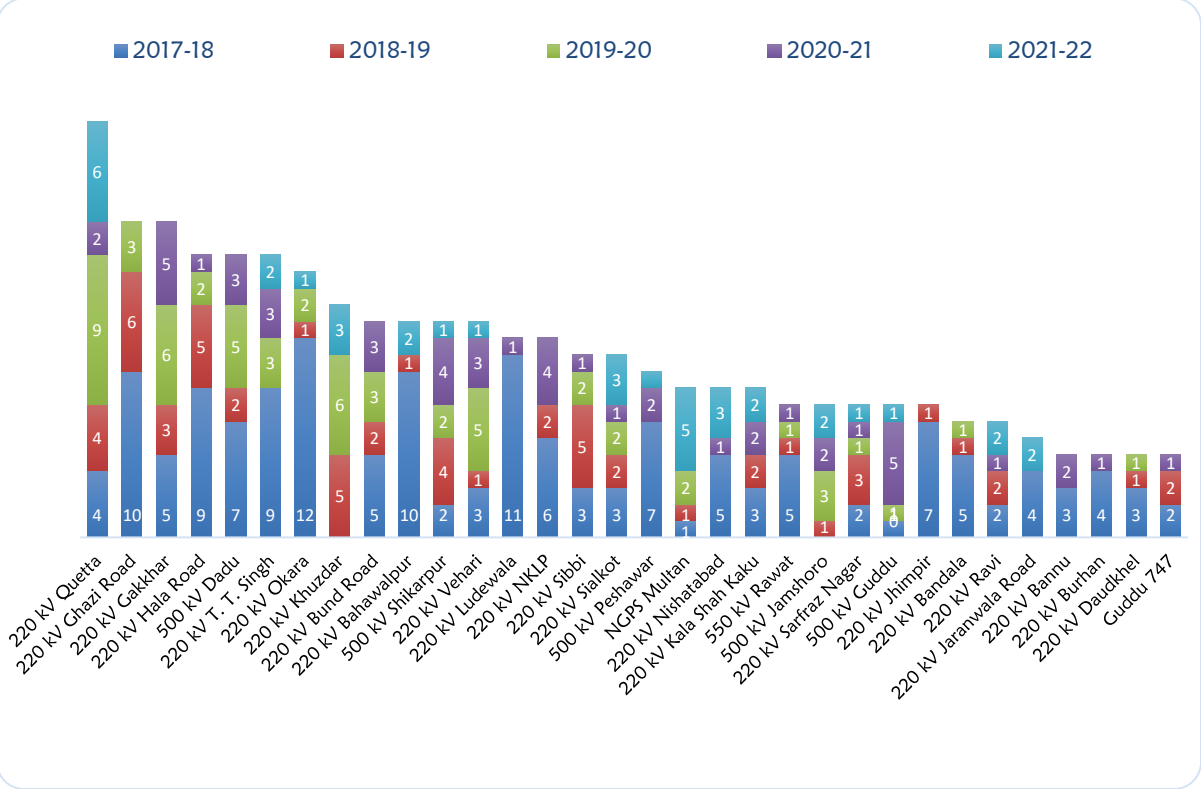
S. No.	Date	Loading at Interruption time	Duration of Interruption	Remarks
1	01-Sep-2021	2000 MW	2 Hrs	**Blackout from Jamshoro to K-Electric** All 500 & 220 kV transmission lines emanating from 500 kV Jamshoro grid station along with 500/220 kV and 220/132 kV Auto T/F's tripped at Jamshoro grid station. The event resulted in power supply failure to K-Electric and HESCO, K2 (1030) MW, Hub Power (60 MW), China Hub Power (600 MW) and all Wind Power Plants (310 MW)
2	23-Mar-2022	966 MW	39 min	500 kV Jamshoro grid station, K2, K-Electric splitted from NTDC network. Circuits affected are given hereunder; 500 kV Jamshoro – Matiari Circuit 1 & 2, 500 kV Jamshoro – Dadu Circuit, 500 kV Jamshoro – China Hub Circuit, 500 kV Jamshoro – K2 Circuit and 220 kV Jamshoro – T. M. Khan Circuit 1 & 2.
3	16-June-2022	370 MW	15 min	220 kV circuits Mangla-NRWT circuit-I, Mangla-NRWT circuit-II, Mangla-GUJRAT circuit-I, Mangla-GUJRAT circuit-II, Mangla-KSK circuit-I, Mangla-KSK circuit-II, Mangla-KSK circuit-III, Mangla-GKR circuit, Bandala-KSK circuit-II and KSK Sahuwala circuit were affected.

It was also observed that after the blackout of 9th January 2021, NTDC was directed to make certain improvements in its transmission network for the improvement of system reliability, stability and security of supply. However, recent events and multiple outages in NTDC's network during the FY 2021-22 indicates that adequate measures have not been taken by NTDC in this regard. NEPRA took serious notice of the partial collapses, initiated legal proceedings against NTDC and imposed a fine of Rs. 10 million accordingly. Dysfunctional SCADA system may also be one of the reasons of frequent outages as a fully functional SCADA system is the need of the hour in better monitoring & control of power system and analyzing of real time disturbances. The Authority has allowed Rs. 3400 million to NTDC in the last three years for installation and commissioning of SCADA system and services as per request of NTDC which is not been in field yet.

Table 3.3: Locational trend of outages

S. No.	Grid/ Plant Name	2017-18	2018-19	2019-20	2020-21	2021-22
1	220 kV Hala Road	9	5	2	1	0
2	NGPS Multan	1	1	2	0	5
3	500 kV Dadu	7	2	5	3	0
4	220 kV Quetta	4	4	9	2	6
5	220 kV Ghazi Road	10	6	3	0	0
6	220 kV Sibbi	3	5	2	1	0
7	220 kV Gakkhar	5	3	6	5	0
8	220 kV T. T. Singh	9	0	3	3	2
9	220 kV Okara	12	1	2	0	1
10	220 kV Bund Road	5	2	3	3	0
11	220 kV Khuzdar	0	5	6	0	3
12	220 kV Ludewala	11	0	0	1	0
13	220 kV NKLP	6	2	0	4	0
14	550 kV Rawat	5	1	1	1	0
15	500 kV Jamshoro	0	1	3	2	2
16	500 kV Peshawar	7	0	0	2	1
17	220 kV Bahawalpur	10	1	0	0	2
18	500 kV Shikarpur	2	4	2	4	1
19	220 kV Vehari	3	1	5	3	1
20	220 kV Sarfraz Nagar	2	3	1	1	1
21	220 kV Bandala	5	1	1	0	0
22	220 kV Bannu	3	0	0	2	0
23	220 kV Nishatabad	5	0	0	1	3
24	500 kV Guddu	1	0	1	5	1
25	220 kV Kala Shah Kaku	3	2	0	2	2
26	220 kV Jaranwala Road	4	0	0	0	2
27	220 kV Ravi	2	2	0	1	2
28	220 kV Burhan	4	0	0	1	0
29	220 kV Shalamar	2	2	0	0	0
30	220 kV T. M. Khan	0	1	2	1	0
31	220 kV Jhimpir	7	1	0	0	0
32	220 kV Sialkot	3	2	2	1	3
33	220 kV Daudkhel	3	1	1	0	0
34	220 kV Gujrat	2	2	0	0	0
35	220 kV Samundri Road	1	2	0	0	0
36	Guddu 747	2	2	0	1	0
Major System Disturbances/Blackouts/Breakdowns/System Splitting(s)						
37	Nos.	4	13	5	6	3

Figure 3.10: Locational trend of loss of supply incidents



The above table and figure shows the locational trend of outages over the period of five years. Among which Quetta, Hala Road, Ghazi Road, Jamshoro, Dadu, Shikarpur and Gakkhar areas are most vulnerable to frequent outages leading to major system disturbances that often result in major system blackouts, collapses and breakdowns. NTDC needs to improve its functions of planning, operation, protection, augmentation & expansions and rehabilitation so that such disturbances may not occur in future.

Transmission network being the backbone of the country's electric power supply system, the Authority allowed a colossal amount to NTDC under the head of repair & maintenance (R&M) to ensure and attain optimal level of network reliability and sustainability. The detail is given hereunder;

Table 3.4: Repair & Maintenance Allowed

Rs. In Millions

2017-18	2018-19	2019-20	2020-21	2021-22
671	988	655	719	790

It is pertinent to highlight that monitoring activities carried out by NEPRA during the period reveal that southern part of the network is vulnerable to frequent outages that lead to major system disturbances owing to aging of equipment and tower collapses. It has also been observed that progress on evacuation projects is slow due to which cheap electricity located in Thar is compromised. Such as the absence of dedicated transmission line for Shanghai Electric Company Limited (SECL) plant, leads to load curtailment of Engro Power Thar Limited (EPTL) and Thar Energy Limited (TEL) due to inadequate transmission capacity. NTDC needs to complete its evacuation projects on priority so that any adverse impact on the power sector may be avoided.

3.3 Quality of Supply

Quality of supply (QoS) is measured with reference to system voltage and system frequency. The analysis of QoS data as reported by NTDC is given hereunder:

3.3.1 System Voltage

The data pertaining to number of voltage violations as submitted by NTDC was analyzed and it was observed that NTDC's performance has declined by 54.5% in the year 2021-22 as compared to preceding year as shown in figure 3.10. Region wise detail of voltage violations is given hereunder;

Figure 3.11: Number of voltage violations (NTDC)

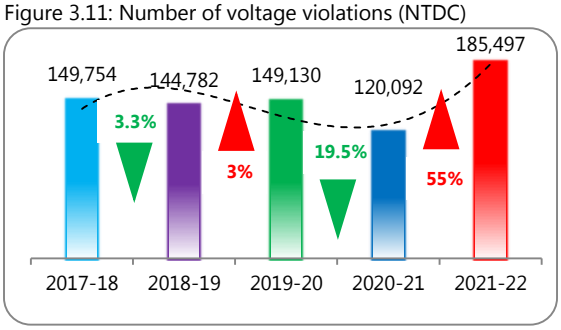


Table 3.5: Number of voltage violations (NTDC Region wise)

System Condition	NTDC Region	2017-18	2018-19	2019-20	2020-21	2021-22
Normal	Islamabad	28,978	30,185	29,577	21,710	28,147
	Lahore	74,718	60,386	47,956	53,393	65,765
	Multan	10,800	14,921	11,868	5,841	15,881
	Hyderabad	25,826	33,850	52,698	38,811	70,304
Total (Normal)		140,322	139,342	142,099	119,755	180,097
N-1	Islamabad	–	–	–	–	–
	Lahore	8,506	3,355	5,009	–	444
	Multan	926	1777	1,770	203	1,805
	Hyderabad	–	308	252	134	3,151
Total (N-1)		9,432	5,440	7,031	337	5,400
Total (Normal & N-1)		**149,754**	**144,782**	**149,130**	**120,092**	**185,497**

The grid station wise breakup for each region is given below.

Table 3.6: Number of voltage violations (NTDC Islamabad Region)

S. No.	Grid Station	2017-18	2018-19	2019-20	2020-21	2021-22
1	500 kV Rawat	6,202	5,165	6,768	4,298	3,464
2	500 kV Peshawar *	2,212	772	2,275	1,417	4,357
3	220 kV Bannu	1,256	1,195	716	664	1,915
4	220 kV Burhan	219	265	1,032	644	468
5	220 kV Daudkhel	1,421	906	684	243	12
6	220 kV ISPR	773	470	1,364	582	1,422
7	220 kV Mardan *	11,359	13,513	5,460	3,999	6,279
8	220 kV Shahibagh *	2,703	2,816	3,620	4,350	4,770
9	220 kV University	2,832	2,812	2,541	2,363	1,469
10	220 kV Mansehra	1	124	56	312	178
11	220 kV Nowshera	19.4.19	NA	1,357	628	2,301
12	220 kV Chakdara	16.9.18	317	578	368	366
13	220 kV D. I. Khan	18.2.19	1,830	3126	1,842	1,146
14	**Total**	**28,978**	**30,185**	**29,577**	**21,710**	**28,147**

* High No. of voltage violations NA: Not applicable

** Date commissioned/energized

Figure 3.12: Number of voltage violations (NTDC Islamabad Region)

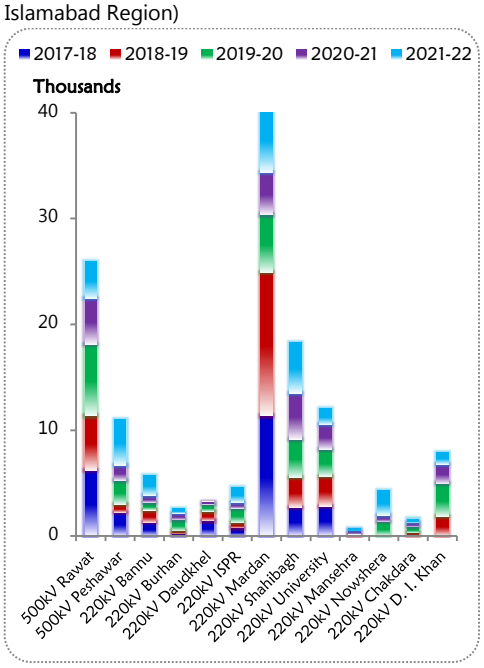


Table 3.7: Number of voltage violations (NTDC Lahore Region)

S. No.	Grid Station	2017-18	2018-19	2019-20	2020-21	2021-22
1	500 kV Gatti	3,155	796	1,026	254	871
2	500 kV Nokhar	710	738	3,012	602	245
3	500 kV Sheikhupura	33,604	8,706	693	173	356
4	500 kV New Lahore	1,474	1,966	3,694	886	1,566
5	500 kV Faisalabad West	**	**	**	**	1,496
6	220 kV Bund Road *	5,502	4,664	6,450	3,420	8,412
7	220 kV Gakkhar	6,544	10,357	661	6,584	3,526
8	220 kV Jaranwala	836	340	4,219	52	268
9	220 kV Kala Shah Kaku *	4,629	4,754	411	4,454	6,471
10	220 kV Ludewala	590	376	3,822	157	757
11	220 kV New Kot Lakhpat	4,285	3,646	1,559	4,735	4,649
12	220 kV New Shalamar	1,777	1,522	268	1,902	1,897
13	220 kV Nishatabad	128	48	4,746	28	12
14	220 kV Ravi	3,693	4,462	606	2,912	3,493
15	220 kV Samundri Road	156	52	3,266	224	1,552
16	220 kV Sarfraz Nagar *	2,968	2,546	2,420	6,162	7,460
17	220 kV Sialkot	2,352	2,425	960	2,350	2,833
18	220 kV WAPDA Town	2,039	1,392	8,932	1,238	937
19	220 kV Ghazi Road *	2,578	6,940	1,800	12,862	12,085
20	220 kV Bandala	1,683	1,192	940	656	456
21	220 kV Toba Tek Singh *	910	1,418	2,632	448	3,171
22	220 kV Gujrat	3,611	5,401	1,026	3,294	3,696
23	**Total**	**83,224**	**63,741**	**52,965**	**53,393**	**66,209**

* High No. of voltage violations ** Reported in 2021-22

Figure 3.13: Number of voltage violations (NTDC Lahore Region)

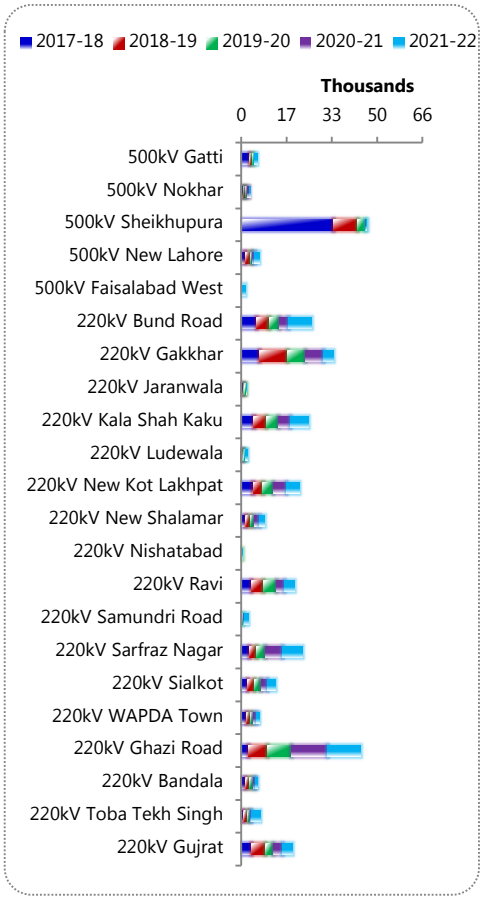


Table 3.8: Number of voltage violations (NTDC Multan Region)

S. No.	Grid Station	2017-18	2018-19	2019-20	2020-21	2021-22
1	500 kV Multan	-	20	28	55	24
2	500 kV Muzaffargarh	-	-	NIL	NA	0
3	500 kV Yousafwala *	543	1,601	1,320	NP	6,126
4	500 kV D.G. Khan	27	194	225	185	233
5	500 kV Rahim Yar Khan	NIL	6	NIL	NA	0
6	220 kV Bahawalpur *	21	836	1,673	833	1,502
7	220 kV Muzaffargarh	650	463	416	329	462
8	220 kV Vehari *	5,335	6,659	2,870	1,659	2,279
9	220 kV Okara	365	884	408	204	606
10	220 kV Kassowal	998	1,274	1,100	144	1,200
11	220 kV Chishtian *	3,787	4,761	4,867	2,427	5,054
12	220 kV Lal Sohanra	15-02-2018		731	208	202
13	**Total**	**11,726**	**16,698**	**13,638**	**6,044**	**17,686**

Date commissioned/energized NA: Not applicable

* High No. of voltage violations

Figure 3.14: Number of voltage violations (NTDC Multan Region)

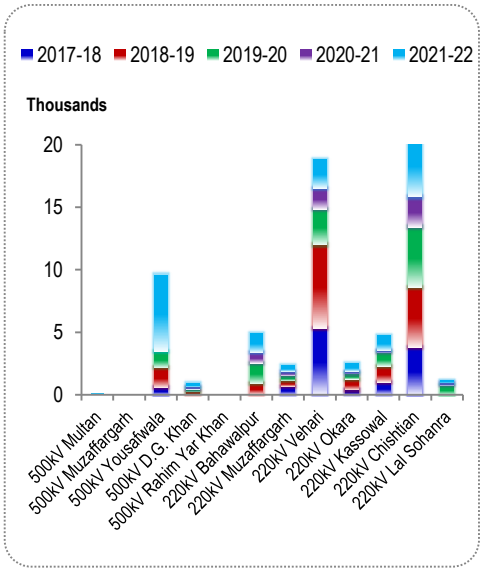
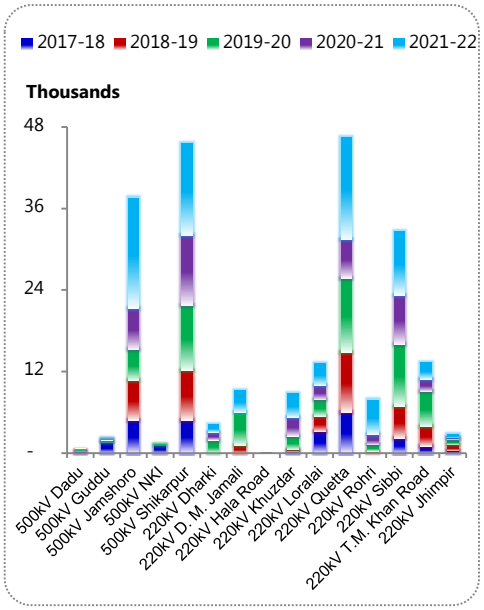


Table 3.9: Number of voltage violations (NTDC Hyderabad Region)

S. No.	Grid Station	2017-18	2018-19	2019-20	2020-21	2021-22
1	500kV Dadu	265	152	113	53	10
2	500 kV Guddu	1,494	46	260	114	165
3	500 kV Jamshoro *	4,874	5,755	4,583	6,086	16,220
4	500 kV NKI	1,118	29	106	NA	NA
5	500 kV Shikarpur *	4,842	7,258	9,602	10,311	13,494
6	220kV Daharki	NA	NA	1,912	1,165	1,178
7	220kV Hala Road	56	20	10	2	NA
8	220kV Quetta *	6,044	8,758	10,936	5,702	15,034
9	220kV Rohri *	70	200	968	1,500	5,104
10	220kV Sibbi *	2,239	4,579	9,186	7,200	9,407
11	220 kV T. M. Khan Road *	1054	2,818	5,208	1,824	2,372
12	220 kV Khuzdar *	282	246	1,966	2,722	3.520
13	220 kV Loralai *	3,140	2,290	2,440	2,064	3,266
14	220 kV Jhimpir	348	888	830	202	410
15	220 kV D. M. Jamali*	2018-19	1,119	4,830	NP	3,275
16	**Total**	**25,826**	**34,158**	**52,950**	**38,945**	**73,455**

Energisation date NA: Not applicable * High No. of voltage violations

Figure 3.15: Number of voltage violations (NTDC Hyderabad Region)



The detailed circuit wise analysis for each region is given at appendix 1 through appendix 4.

Figure 3.16: Highest voltage (kV) recorded at 500 kV grid stations under Normal condition

Figure 3.17: Highest voltage (kV) recorded at 220 kV grid stations under Normal condition

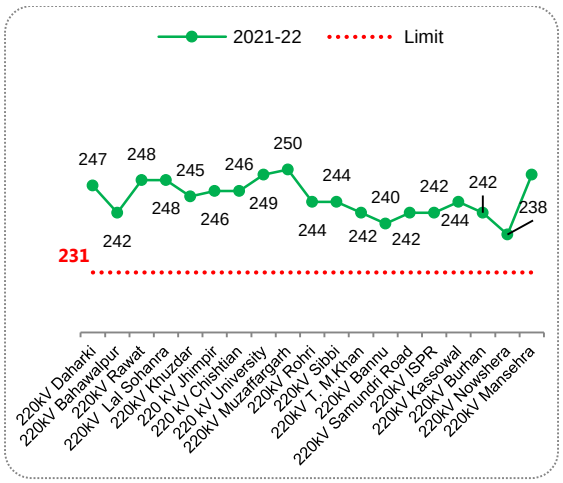
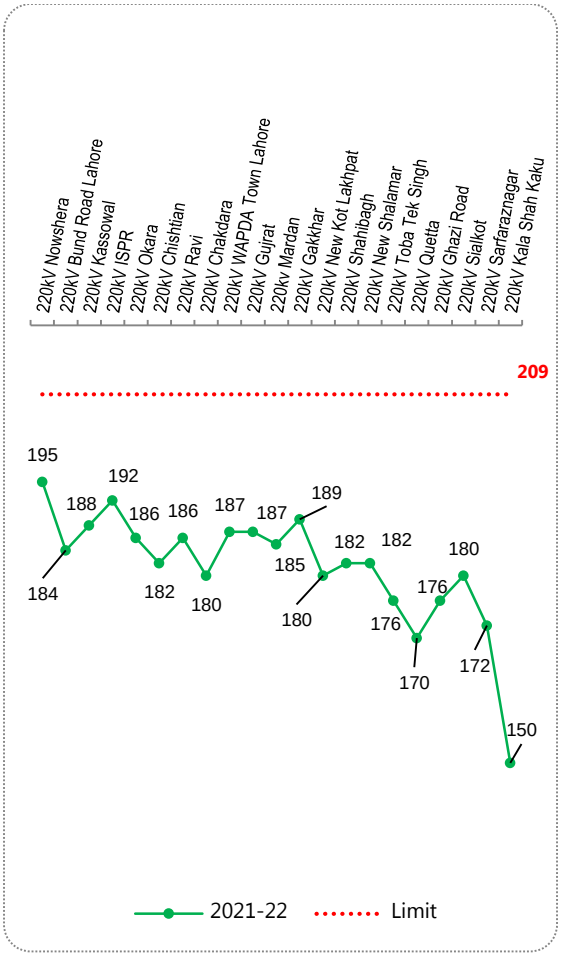


Figure 3.18: Lowest voltage (kV) recorded at 220 kV grid stations under Normal condition



Highest voltage of 250 kV was recorded at Muzaffargarh. It indicates 8.2% deviation with respect to allowed limit (+5% = 231 kV). Detail of highest voltage incidents is given below.

Table 3.10: Highest voltage incidents

S. No.	Name of Grid Station	NTDC Region	Highest Voltage Recorded (kV)	Duration of Variation (min)	Deviation w.r.t Allowed Limit (%)
1	220 kV Muzaffargarh	Multan	250	300	8.2%
2	220 kV University	Islamabad	249	60	7.8%
3	220kV Mansehra	Islamabad	249	60	7.8%
4	220 kV Rawat	Islamabad	248	120	7.4%
5	220kV Lal Sohanra	Multan	248	30	7.4%
6	220kV Daharki	Hyderabad	247	60	6.9%
7	220 kV Jhimpir	Hyderabad	246	60	6.5%
8	220 kV Chishtian	Multan	246	120	6.5%
9	220kV Khuzdar	Hyderabad	245	60	6.1%
10	220kV Rohri	Hyderabad	244	120	5.6%
11	220kV Sibbi	Hyderabad	244	60	5.6%
12	220kV Kassowal	Multan	244	60	5.6%
13	220kV Bahawalpur	Multan	242	120	4.8%
14	220kV T. M. Khan	Hyderabad	242	60	4.8%
15	220kV Samundri Road	Lahore	242	180	4.8%
16	220kV ISPR	Islamabad	242	60	4.8%
17	220kV Burhan	Islamabad	242	60	4.8%
18	220kV Bannu	Islamabad	240	60	3.9%
19	220kV Nowshera	Islamabad	238	60	3.0%

The voltage remained as low as 150 kV, recorded at Kala Shah Kaku that indicates 28.2% deviation with respect to allowed limit (-5% = 209 kV) which may affect the consumer end voltages and consequently equipment damage. Lowest voltage incidents are given hereunder.

Table 3.11: Lowest voltage incidents

S. No.	Name of Grid Station	NTDC Region	Lowest Voltage Recorded (kV)	Duration of Variation (min)	Deviation w.r.t Allowed Limit (%)
1	220kV Kala Shah Kaku	Lahore	150	60	28.2%
2	220kV Quetta	Hyderabad	170	90	18.7%
3	220kV Sarfaraznagar	Lahore	172	60	17.7%
4	220kV Toba Tek Singh	Lahore	176	180	15.8%
5	220kV Ghazi Road	Lahore	176	1440	15.8%
6	220kV Chakdara	Islamabad	180	30	13.9%
7	220kV New Kot Lakhpat	Lahore	180	90	13.9%
8	220kV Sialkot	Lahore	180	60	13.9%
9	220kV Chishtian	Multan	182	90	12.9%
10	220kV Shahibagh	Islamabad	182	30	12.9%
11	220kV New Shalamar	Lahore	182	60	12.9%
12	220kV Bund Road Lahore	Lahore	184	120	12.0%
13	220kv Mardan	Islamabad	185	150	11.5%
14	220kV Okara	Multan	186	60	11.0%
15	220kV Ravi	Lahore	186	90	11.0%
16	220kV WAPDA Town	Lahore	187	1260	10.5%
17	220kV Gujrat	Lahore	187	60	10.5%
18	220kV Kassowal	Multan	188	60	10.0%
19	220kV Gakkhar	Lahore	189	330	9.6%
20	220kV ISPR	Islamabad	192	120	8.1%
21	220kV Nowshera	Islamabad	195	90	6.7%

Grid stations identified with high number of voltage violations are given in the following table.

Table 3.12: Grids with high number of voltage violations

S. No.	Name of Grid Station	NTDC Region	2017-18	2018-19	2019-20	2020-21	2021-22
1	500 kV Jamshoro	Hyderabad	4,874	5,755	4,583	6,086	16,220
2	500 kV Shikarpur	Hyderabad	4,842	7,258	9,602	10,311	13,494
3	220kV Quetta	Hyderabad	6,044	8,758	10,936	5,702	15,034
4	220kV Rohri	Hyderabad	70	200	968	1,500	5,104
5	220kV Sibbi	Hyderabad	2,239	4,579	9,186	7,200	9,407
6	220 kV T. M. Khan Road	Hyderabad	1054	2,818	5,208	1,824	2,372
7	220 kV Khuzdar	Hyderabad	282	246	1,966	2,722	3.520
8	220 kV Loralai	Hyderabad	3,140	2,290	2,440	2,064	3,266
9	220 kV Jhimpir	Hyderabad	348	888	830	202	410
10	220 kV D. M. Jamali	Hyderabad	2018-19	1,119	4,830	NP	3,275
11	220 kV Bund Road	Lahore	5,502	4,664	6,450	3,420	8,412
12	220 kV Kala Shah Kaku	Lahore	4,629	4,754	411	4,454	6,471
13	220 kV Sarfraz Nagar	Lahore	2,968	2,546	2,420	6,162	7,460
14	220 kV Ghazi Road	Lahore	2,578	6,940	1,800	12,862	12,085
15	220 kV Toba Tek Singh	Lahore	910	1,418	2,632	448	3,171
16	500 kV Yousafwala	Multan	543	1,601	1,320	NP	6,126
17	220 kV Bahawalpur	Multan	21	836	1,673	833	1,502
18	220 kV Chishtian	Multan	3,787	4,761	4,867	2,427	5,054
19	500 kV Peshawar	Islamabad	2,212	772	2,275	1,417	4,357
20	220 kV Mardan	Islamabad	11,359	13,513	5,460	3,999	6,279
21	220 kV Shahibagh	Islamabad	2,703	2,816	3,620	4,350	4,770

By linking the above-mentioned analysis of voltage violations and voltage profile with system constraints data submitted by NTDC, it has been revealed that most of these grid stations are overloaded. The detail is summarized in the following table.

Table 3.13: System Constraints Removal

S. No.	Grid Station	Constraint Since	Interim Arrangement	Proposed Way Forward	Completion Reported in 2020-21	Completion Reported in Dec 2022	Delay
1	500 kV Sheikhupura 220/132 kV 4x160 MVA transformers	Aug 2019	• Load shifting for short duration keeping in view the loading of Ravi, KSK & SKP. • Generation of Saba, Halmore & Sapphire provides support.	• Augmentation of 4x160 MVA to 4x250 MVA Transformers	-	• Sep 2023	-
2	500 kV Gatti	June 2017	• X-Trip Scheme implemented to cover contingency. • Commitment of generation at Liberty Tech. power house.	• Commissioning of Trimmu P/H • 500 kV Faisalabad West Grid Station	• Mar 2022 • Dec 2021	• Mar 2022 • Jan to Apr 2022	• Completed • Completed
3	500 kV Rawat 220/132 kV T-5, T-6, T-7 Overloaded	June 2017	• Load shifting for short duration. • Commitment of generation at Attock Gen Limited.	• 500 kV Islamabad West Grid Station • 500 kV Chakwal Grid Station	• Dec 2023 • 2024-25	• Dec 2023 • 2024-25	-
4	500 kV Nokhar 2x600 MVA Transformers Overloaded	June 2018	• X-Trip Scheme implemented. • Commitment of generation at Nandipur & HUBCO.	• Addition of 1x600 MVA Transformer • 500 kV Lahore North Grid Station	• July 2022 • Nov 2023	• July 2022 • Mar 2024	• 4 months
5	220 kV Sarfraz Nagar 4x transformers	June 2018	• Load sharing by Transformers at 220 kV Okara Grid Station. • Commitment of generation at Nishat Chunian, Nishat Power and Kohinoor Plants.	• Completion of 220 kV Sundar Grid Station • Completion of 220 kV Kasur Grid Station	• 2023-24 • 2024-25	• 2023-24 • 2024-25	-
6	220 kV New Kot Lakhpat	June 2019	• Load shifting for short duration keeping on view the loading of Bund Road, WAPDA Town, Shalamar, Ghazi Road, Ravi & NKLP.	• Addition of 1x250 MVA Transformer • 220 kV Punjab University Grid Station	• July 2023 • 2023-24	• Feb 2024 • Legal & land issues	• 8 months
7	220 kV WAPDA Town 3x transformers	June 2019	• Load shifting for short duration keeping on view the loading of Bund Road, WAPDA Town, Shalamar, Ghazi Road, Ravi & NKLP.	• Augmentation of 3x160 MVA Transformers to 3x250 MVA Transformers	• Feb 2023	• Sep 2023	• 7 months
8	220 kV Chishtian 2x transformers	June 2018	• Load shifting for short duration keeping on view the loading of Vehari, Bahawalpur & Yousafwala.	• Addition of 1x160 MVA Transformer	• Jan 2022	• Feb 2022	• Completed
9	220 kV Quetta Industrial 2x transformers	June 2017	• Load shifting for short duration keeping in view the loading of Quetta, Khuzdar & Loralai.	• 220 kV Mastung Grid Station	• 2023-24	• 2023-24	-
10	220 kV ISPR Sangjani 4x transformers	June 2018	• Load shifting for short duration keeping in view the loading of Burhan, ISPR, University & Rawat.	• 500 kV Islamabad West Grid Station • 220 kV Zero Point Grid Station	• Dec 2023 • 2023-24	• Apr 2024 • 2023-24	• 4 months

S. No.	Grid Station	Constraint Since	Interim Arrangement	Proposed Way Forward	Completion Reported in 2020-21	Completion Reported in Dec 2022	Delay
11	220 kV University 2x transformers	June 2018	• Load shifting for short duration keeping in view the loading of Burhan, ISPR, University & Rawat.	• Addition of 1x250 MVA Transformer • 500 kV Islamabad West Grid Station	• July 2023 • Dec 2023	• Feb 2024 • Apr 2024	• 7 months • 4 months
12	220 kV Kassowal 2x transformers	June 2017	• Load shifting for short duration keeping in the loading of Jaranwala, Vehari, NGPS & T. T. Singh. • Commitment of generation at Fauji Kabirwala P/H.	• Addition of 1x160 MVA Transformer • 220 kV Arifwala Grid Station	• Jan 2022 • 2023-24	• Jan 2022 • 2023-24	• Completed
13	500 kV Yousafwala 220/132 kV T-3, T-4, T-5, T-6	June 2018	• Load shifting for short possible duration Commitment of generation at Saif P/H.	• 220 kV Arifwala Grid Station	• 2023-24	• 2023-24	-
14	220 kV Gakkhar 4x transformers	June 2019	• Load shifting for short duration keeping in view the loading of 500 kV Nokhar, 220 kV Gujrat, Sialkot, Gakkhar & Mangla. • Commitment of generation at HUBCO Narowal and Nandipur.	• Augmentation from 3x160 MVA to 3x250 MVA at Nokhar • Completion of 220 kV Gujranwala II Grid Station	• July 2023 • 2023-24	• July 2023 • 2024-25	• 12 months
15	220 kV Sialkot 3x transformers	June 2019	• Load shifting for short duration keeping in view the loading of 500 kV Nokhar, 220 kV Gujrat, Sialkot, Gakkhar & Mangla. • Commitment of generation at HUBCO Narowal and Nandipur.	• Augmentation from 3x160 MVA to 3x250 MVA at Nokhar • 220 kV Gujranwala II Grid Station	• July 2023 • 2023-24	• July 2023 • 2024-25	• 12 months
16	220 kV Ravi 3x transformers	June 2019	• Load shifting for short duration keeping on view the loading of Bund Road, WAPDA Town, Shalamar, Ghazi Road, Ravi & NKLP.	• Addition of 1x250 MVA Transformer	• 2022-23	• 2022-23	-
17	220 kV Daudkhel 2x transformers	June 2018	• Load shifting for short duration keeping on view the loading of Bund Road, WAPDA Town, Shalamar, Ghazi Road, Ravi & NKLP. • Load management of 50 to 60 MW as a last resort in case no margin is available of shifting is available on either sides. • Generation of Jinnah Hydel supports too.	• Addition of 1x160 MVA Transformer	• Dec 2022	• Feb 2023	• 2 months
18	220 kV Ludewala 2x transformers	June 2017	• Load shifting for short duration keeping on view the loading of Bund Road, WAPDA Town, Shalamar, Ghazi Road, Ravi & NKLP. • Load management of 50 to 60 MW as a last resort in case no margin is available of shifting is available on either sides. • Generation of Jinnah Hydel supports too.	• Augmentation from 1x160 MVA to 1x250 MVA at Ludewala • 220 kV Lalian Grid Station	• July 2023 • May 2022	• Feb 2024 • Nov 2022	• 7 months • Completed with 6 months delay.
19	220 kV Vehari 2x transformers	June 2017	• Load shifting for short keeping in view the loading NGPS, Chishtian, Kassowal & Yousafwala.	• Augmentation from 2x160 MVA to 2x250 MVA at Vehari • 220 kV Arifwala Grid Station	• Dec 2022 • 2023-24	• Dec 2022 • 2023-24	-

S. No.	Grid Station	Constraint Since	Interim Arrangement	Proposed Way Forward	Completion Reported in 2020-21	Completion Reported in Dec 2022	Delay
20	500 kV Jamshoro 220/132 kV 2x transformers	June 2017	• Load shifting for short keeping in view the loading of Jamshoro & T. M. Khan.	• 220 kV Mirpur Khas Grid Station	• June 2022	• Oct 2023	• 16 months

S. No.	Transmission Line	Constraint Since	Interim Arrangement	Proposed Way Forward	Completion Reported in 2020-21	Completion Reported in Dec 2022	Delay
21	220kV Multan – T. T. Singh cct 1& 2 overloaded	June 2018	-	• 500 kV Faisalabad West Grid Station	• Dec 2021	• Jan to Apr 2022	• Completed
22	220kV Gatti – Bandala cct 1& 2	June 2014	• X-Trip Scheme implemented to cover contingency.	• Up gradation of conductor with higher current carrying capacity	• Feb 2023	• Mar 2022	• Completed
23	220kV Samundri – T. T. Singh cct 1& 2	June 2014	• Load shedding and load shifting	• Addition of 220 kV double circuit transmission line from T. T. Singh to Jaranwala Road via Samundri Road. • 500 kV Faisalabad West Grid Station	• 2021-22 • Dec 2021	• Apr 2022 • Jan to Apr 2022	• Completed • Completed
24	220 kV Uch-II – Shikarpur cct And 220 kV Shikarpur – Uch cct	June 2014	• Curtailment of Uch and Uch-II full generation in winter season in case of outage of any 220 kV cct in the region	• Construction of 220 kV Guddu-Shikarpur-Uch-Sibbi transmission line	• June 2022	• Dec 2022	• 6 months

It is pertinent to highlight that over the years NTDC has been reporting constraints in transmission system as one of the major causes of under-utilization of efficient power plants. During the period, at several instances, the transmission system remained incapable to transmit the electric power from efficient power plants to load centers. NTDC is still requiring a longer period to fix the existing constraints which are causing the operation of power plants in violation of EMO. NTDC needs to take measures/steps to remove constraints in its network to off-take electric power from existing power plants as well as upcoming power projects in light of the Transmission System Expansion Plan (TSEP) duly integrated with the plan for induction of new generation plants in accordance with Indicative Generation Capacity Expansion Plan (IGCEP). NEPRA has allowed a substantial amount to NTDC for removal of system constraints that has a considerable financial impact on account of operation of expensive plants due to transmission system constraints. NTDC's progress on removal of system constraints is slow and around 11 projects are delayed as mentioned in the table above and requires to be expedited to avoid any adverse impacts on the power sector. Grid station wise transformers loading position is attached at appendix 5, wherein, loading has been indicated in three different categories along with color code.

i. Loading Above 80%
ii. Loading from 70% to 80% &
iii. Loading below 70%

3.3.2 System Frequency

The data submitted by NTDC was analyzed and it revealed that a total of 4 times frequency remained outside the prescribed limits and that comes out to be approximately 0.005% of the reported period. The following table shows statistics of system frequency over the reported period.

Table 3.14: System frequency stats

Month	Number of days/hours for a month over a year		Frequency violation recorded (Hz)		Duration of variation		Variation (%)			Number of times frequency remained outside the limits
	Days	Hours	Highest	Lowest	Mins	Hrs	Highest	Lowest	Period	Nos.
1	2	3	4	5	6	7	8=(4-50)/50*100	9=(5-50)/50*100	10=7/3*100	11
July	31	744	50.59	Nil	7	0.12	1.18	Nil	0.02	1
Aug	31	744	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Sep	30	720	50.54	Nil	Nil	0.12	1.08	Nil	0.02	1
Oct	31	744	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Nov	30	720	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Dec	31	744	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Jan	31	744	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Feb	28	672	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Mar	31	744	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Apr	30	720	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
May	31	744	50.61	Nil	6	0.1	1.22	Nil	Nil	1
June	30	720	50.66	Nil	13	0.22	1.32	Nil	Nil	1
Year	**365**	**8760**	**50.66**	**Nil**	**26**	**0.44**	**1.44**	**Nil**	**0.005**	**4**

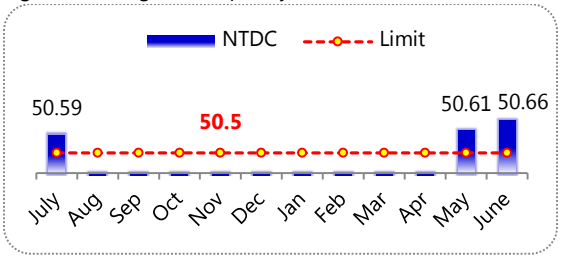
Other details assessed pertaining to system frequency with a comparison to the preceding years is given in the following table;

Table 3.15: System frequency details with comparison

▼ Description / Unit / Year ►	Unit	2017-18	2018-19	2019-20	2020-21	2021-22
Number of times Frequency remained outside the Limits in a Year	In a year	25	25	9	4	3
	Average/month	2.1	2.1	0.8	0.3	0.25
	Average/day	0.068	0.068	0.024	0.01	0.01
Time duration the Frequency remained outside the Limits in a Year	Days	0.17	0.12	0.03	0.02	0.02
	Hours	4.1	2.98	0.8	0.6	0.4
	%age of year	0.047	0.034	0.009	0.007	0.005

The following figure shows month wise highest frequency incidents beyond the permissible limit for the year 2021-22. The dotted red line shows the upper limit (50.5 Hz). As reported, lower limit has not been violated.

Figure 3.19: Highest frequency recorded (Hz)



K - Electric

4 Brief about KE

K-Electric (KE) formerly known as Karachi Electric Supply Company was established on September 13, 1913 under the Indian Companies Act of 1882 as the Karachi Electric Supply Corporation (KESC). The entity was nationalized in 1952 and re-privatized on November 29, 2005. In September, 2008 it was renamed as Karachi Electric Supply Company (KESC). Thereafter, it was rebranded as K-Electric (KE).

4.1 Licence

KE was granted Transmission Licence on 10th June 2010 by NEPRA to engage in the transmission business within the territory as specified in its license for a term of thirty (30) years, pursuant to Section 17 of the Regulation of Generation Transmission and Distribution of Electric Power Act, 1997.

4.2 Transmission Network

KE's transmission system comprises a total of 1,355 km of 220 kV, 132 kV and 66 kV transmission lines, 71 grid stations, 20 Auto Transformers and 175 power transformers, as of June 2022. K-Electric grid is interconnected with the NTDC grid system through four (04) 220 kV transmission circuits, namely;

i. KDA-NKI
ii. Baldia-NKI
iii. KDA-Jamshoro-1
iv. KDA-Jamshoro-2

Figure 4.1: KE transmission system

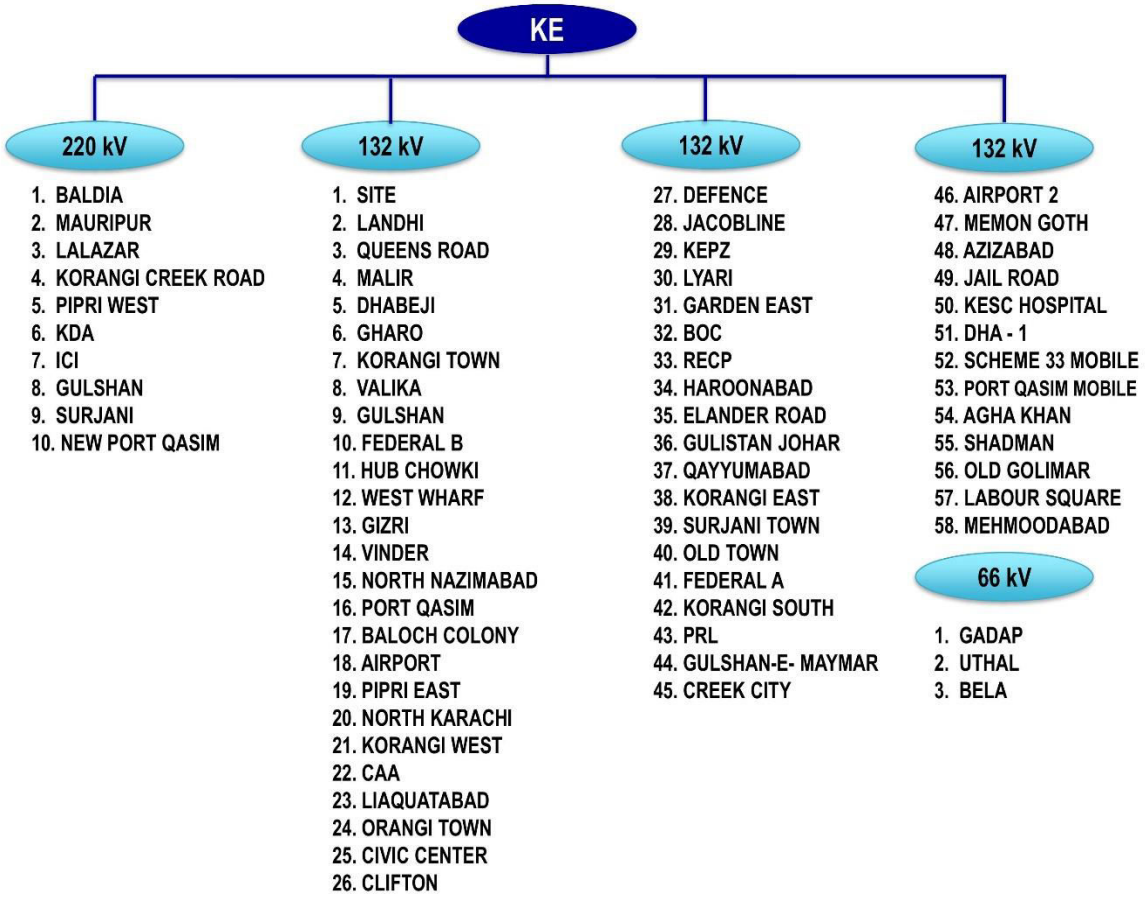


Table 4.1: KE Network Statistics

Description		2017-18	2018-19	2019-20	2020-21	2021-22
No. of Grid Stations	220 kV	7	9	10	10	10
	132 kV	54	56	57	58	58
	66 kV	3	3	3	3	3
	Total	**64**	**68**	**70**	**71**	**71**
Length of Transmission Line (Circuit km)	220 kV	338	336	365	364	364
	132 kV	767	798	801	836	838
	66 kV	149	150	153	152	153
	Total	**1,254**	**1,284**	**1,319**	**1,352**	**1,355**
Transformation Capacity (MVA)	220 kV	3,000	3,500	4,500	4,500	4,500
	132 kV	5,549	6,109	6,373	6,674	6,824
	66 kV	69	69	79	79	79
	Total	**8,618**	**9,678**	**10,952**	**11,253**	**11,403**

4.3 Performance at a Glance

An overview of the performance of KE is given hereunder in light of the reported data;

System Reliability

Average Duration of Interruption

1. Total outages hours recorded at all interconnection points (excluding 132 kV line tripping) = **0 Hrs**
2. Total number of interconnection points = 9
3. System duration of interruption = **0 Hrs/point**

*Indicates an 100% improvement over the previous year i.e. **0.06 Hrs/point***

Average Frequency of Interruption

1. Total number of outages recorded at all 132 kV outgoing circuits (excluding 132 kV line tripping) = **0**
2. Total number of 132 kV circuits = 46
3. System frequency of interruption = **0 Nos./circuit.**

*Indicates a 100% reduction over the previous year i.e. **0.02 Nos./circuit***

System Security

Energy Not Served (ENS)

1. Total ENS = **0 kWh**
2. Number of incidents, where there has been a loss of supply = **0**
3. Average ENS per incident = **0 kWh**
4. Average duration per incident = 0
5. Financial impact of ENS = **Nil**
6. Financial impact per incident = Nil

100% reduction in ENS as compared to preceding year's 0.685 million kWh.

Quality of Supply

Voltage

1. Total number of violations under Normal conditions = **46**
2. Total number of violations under N-1 conditions = **Nil**
3. Total number of violations under Normal & N-1 conditions = **46**

Frequency

3. Number of times frequency remained outside the limits in a year = **1**
4. Time duration the frequency remained outside the limits in a year = 9 **min.**
5. %age time of the year the frequency remained outside the limits = **0.002% time of the year.**

1. Highest frequency recorded = **50.53 Hz**
2. No violation at lower end.

Allowable limits: 49.5 Hz – 50.5 Hz

5 Analysis of KE's Annual Performance Report (APR)

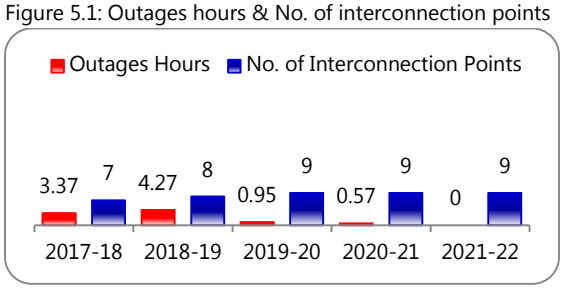
The Annual Performance Report submitted by KE has been analyzed in light of the PSTR 2005. The detail is given hereunder;

5.1 System Reliability

5.1.1 System Duration of Interruption

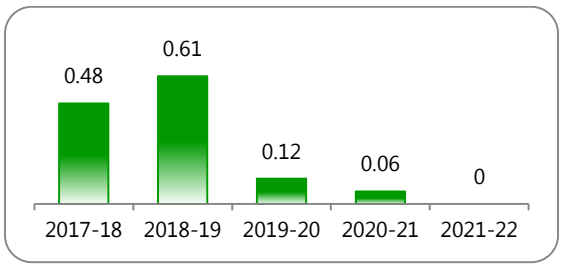
The total outages hours recorded at all interconnection points are 0 during the reported period, indicating a 100% reduction in comparison to the preceding year's 0.57 hours. Number of interconnection points remained the same i.e. 9. The same has been shown in figure 5.1.

Figure 5.1: Outages hours & No. of interconnection points



The average duration of interruption per interconnection point the reported is 0 hours. This indicates 100% decrease over the previous year i.e. 0.06 hours (4 minutes) as shown in figure 3.2.

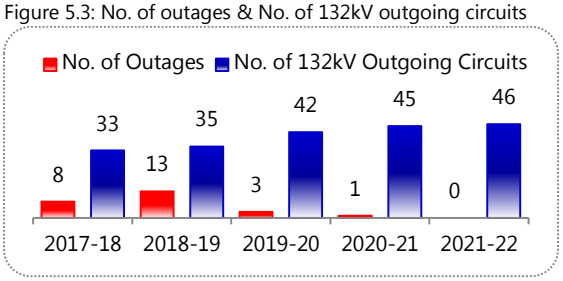
Figure 5.2: System duration of interruption (Hrs/Point)



5.1.2 System Frequency of Interruption

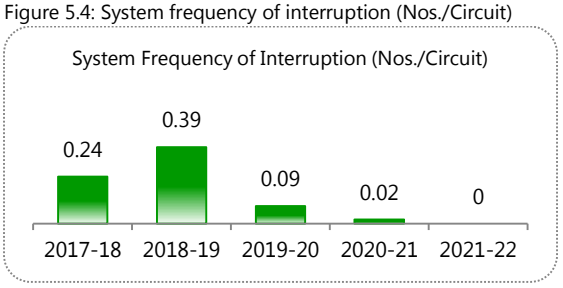
The total number of outages remained 0 in the year 2021-22 that shows a reduction of around 100% as compared to preceding year's 1 outage as shown in the flowing figure.

Figure 5.3: No. of outages & No. of 132kV outgoing circuits



Average number of interruptions per circuit during the reported period remained 0 indicating 100% reduction in comparison to the preceding year's 0.02 as shown in figure 3.4.

Figure 5.4: System frequency of interruption (Nos./Circuit)



5.2 System Security

In order to gauge system security, the estimates of total energy not served (ENS) during the reported period has been analyzed. The total ENS as reported by KE is 0 million kWh indicating a 100% reduction in comparison to preceding year i.e. 0.685 million kWh. The detail is given hereunder: -

Figure 5.5: Reported ENS

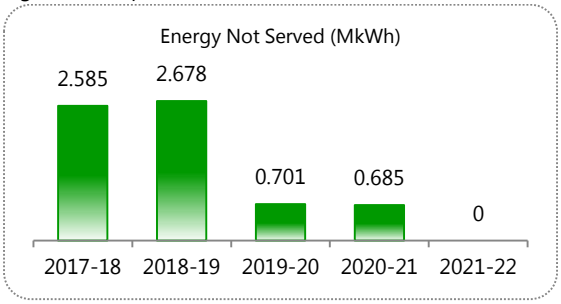


Figure 5.6: Loss of supply incidents & duration per incident

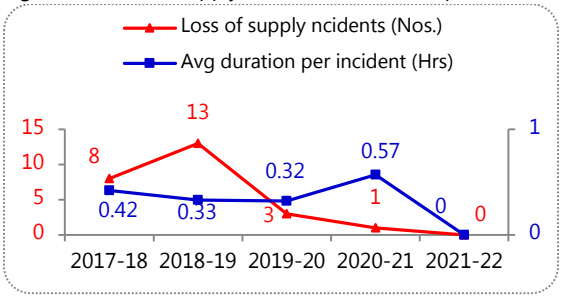


Figure 5.7: Loss of supply incidents along with average

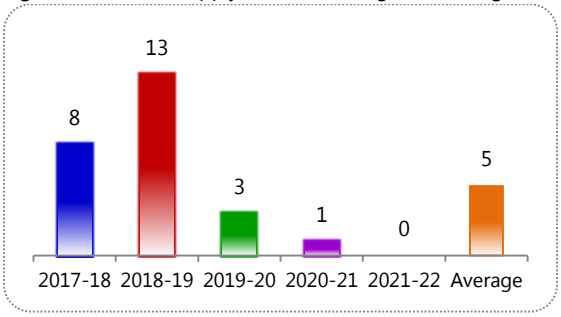


Table 5.1: Loss of supply incidents, average ENS, duration & financial impact per incident

Description	2017-18	2018-19	2019-20	2020-21	2021-22
Loss of Supply Incidents (Nos.)	8	13	3	1	0
Average ENS per Incident (Million kWh)	0.323	0.206	0.234	0.685	0
Average Duration per Incident (Hrs : Min)	00 : 25	00 : 20	00 : 19	0.57	0
Financial Impact per Incident Rs. (Million)	4.1	2.6	2.2	6.85	0

It is pertinent to highlight that during the reported period two partial collapses occurred and KE's system collapsed as well that nullifies its stance of zero outages. Furthermore, it is important to highlight that KE being a vertically integrated utility having a generation fleet of around 2,817 MW has failed to survive during major incidents repeatedly which is a matter of serious concern.

KE being the responsible entity for providing reliable power to its consumers and especially the city of Karachi being the economic hub of the country, it is of paramount importance to take measures/steps to operate in island mode in the event of external major incidents to avoid unnecessary power cuts.

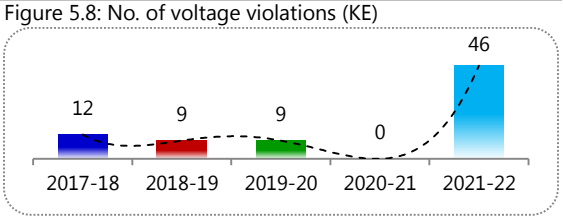
5.3 Quality of Supply

Quality of supply (QoS) is measured with reference to system voltage and system frequency. The analysis of QoS data as reported by KE is given hereunder:

5.3.1 System Voltage

KE has reported 43 voltage violations under normal condition indicating 100% increase as compared to preceding year. The following figure shows the trend, over the previous 5 years.

Figure 5.8: No. of voltage violations (KE)



5.3.2 System Frequency

The data submitted by KE was analyzed and it revealed that only 1 time frequency remained outside the prescribed limit (upper) i.e. 50.53 Hz for 9 minutes and that comes out to be approximately 0.002% of the reported period.

6 Recommendations

i. The equipment which have exhausted their useful life should be replaced with new one at all the grid stations on as and when required basis.

ii. The volume of power being evacuated in south especially at 500 kV Jamshoro has enormously increased in recent years due to thermal, nuclear and wind generation addition. This has resulted in increased short circuit fault level at 500 kV Jamshoro. Therefore, short circuit studies shall be carried out at aforesaid grid in particular and all other grids in general to determine the actual fault level for proper primary equipment selection/installation.

iii. Event fault recorders shall be installed for better fault analysis to avoid outages. Behavior of bus-bar protection relays shall be reviewed and tested thoroughly.

iv. Behavior of bus-bar protection relays shall be reviewed and tested thoroughly to avoid cascaded outages.

v. NTDC shall complete the system constraints removal projects to eradicate the financial impact caused due to merit order violation on account of system constraints and power evacuation projects to bring in most economical power into the national grid at the earliest.

vi. KE being the responsible entity for providing reliable power to its consumers and especially the city of Karachi being the economic hub of the country, it is of paramount importance to take measures/steps to operate in island mode in the event of external major incidents to avoid unnecessary power cuts.

APPENDIX 1

Voltage violations data - detailed circuit wise analysis

NTDC Islamabad Region

1. 500 kV Rawat
2. 500 kV Peshawar
3. 220 kV Bannu
4. 220 kV Burhan
5. 220 kV Daudkhel
6. 220 kV ISPR (Sangjani)
7. 220 kV Mardan
8. 220 kV Nowshera
9. 220 kV Shahibagh
10. 220 kV University
11. 220 kV Mansehra
12. 220 kV Chakdara
13. 220 kV D. I. Khan

NTDC Islamabad Region

1. 500kV Grid Station RAWAT

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Rawat - Barotha Ckt I & II	552	482	223	195	60	541	60	553	60	537	150	539	120	542	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Rawat - Gakkhar Ckt I & II	548	481	223	195	60	544	180	553	60	537	150	539	120	542	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Rawat - Tarbela	276	481	223	195		541	60	553	60	537	150	539	120	542	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Rawat - Neelum Jehlum	53	479	223	195	60	544	180	553	60	537	150	539	120					–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–
Normal	220 kV Rawat - ISPR Ckt I & II	798	534	1469	879	821	241	60	246	60	245	180	245	240	248	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Rawat - Mangla Ckt I & II	1604	1068	1469	879	821	243	90	246	60	245	180	245	240	248	90	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Rawat - Bahria Town Ckt I & II	793	589	1469	881	821	241	90	246	60	245	180	245	240	248	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Rawat - University Ckt I & II	1578	1051	1469	879	821	243	60	246	60	245	180	245	240	248	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–			–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

*Energized in May 2018

Total No. of Variations (Normal)	6,202	5,165	6,768	4,298	3,464
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	6,202	5,165	6,768	4,298	3,464

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

NTDC Islamabad Region

2. 500kV Grid Station SHEIKH MUHAMMADI PESHAWAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Tarbela - Peshawar	58	19	432	172	632	527	60	538	60	541	60	536	60	553	60	–	–	–	–	468	60	473	60	469	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Barotha - Peshawar	549	209	NP			236	60	238	60	NP				239	60	180	60	198	60	NP					
N-1		–	–				–	–	–	–					–	–	–	–	–	–					–	–
Normal	220 kV Peshawar - Daudkhel Ckt I & II	1062	251	587	415	1244	236	60	238	60	238	60	234	60	239	60	180	60	180	60	185	60	199	60	192	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Peshawar - Shahibagh	543	251	621	415	1241	236	60	238	60	238	60	234	60			175	60	180	60	185	60	199	60		
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Peshawar - Nowshera	Added in 2018-19	42	635	415	1240	Added in 2018-19		–	–	238	60	234	60	239	60	Added in 2018-19		180	60	186	60	199	60	192	60
N-1			–	–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–

NP: Not Provided

Total No. of Variations (Normal)	2,212	772	2,275	1,417	4,357
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	2,212	772	2,275	1,417	4,357

Highest Voltage Under Normal Condition @500kV level

Lowest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

Lowest Voltage Under Normal Condition @220kV level

NTDC Islamabad Region

3. 220kV Grid Station BANNU

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Daudkhel - Bannu Ckt I & II	651	586	358	332	1238	241	60	241	60	240	60	241	60	240	60	174	60	198	60	200	60	203	60	188	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Chashma - Bannu Ckt I & II	605	609	358	332	677	241	60	241	60	240	60	241	60	240	60	180	60	196	60	200	60	203	60	203	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	1,256	1,195	716	664	1,915
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	1,256	1,195	716	664	1,915

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Islamabad Region

4. 220kV Grid Station BURHAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Burhan - ISPR Ckt I & II	51	130	516	322	234	–	–	241	60	235	120	238	180	242	60	200	120	–	–	194	60	204	60	201	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Burhan - Tarbela Ckt I, II & III	168	135	516	322	234	232	60	241	60	235	120	238	180	242	60	200	120	206	60	194	60	204	60	201	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	219	265	1,032	644	468
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	219	265	1,032	644	468

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Islamabad Region

5. 220kV Grid Station DAUDKHEL

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Daudkhel - Peshawar Ckt I & II	566	302	228	81	4	240	90	244	60	242	240	238	540	234	240	194	60	204	60	204	60	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Daudkhel - Chashma Ckt I & II	276	302	228	81	4	241	180	244	60	242	240	238	540	234	240	193	90	204	60	204	60	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Daudkhel - Bannu Ckt I & II	579	302	228	81	4	241	180	244	60	242	240	238	540	234	240	194	60	204	60	204	60	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	1,421	906	684	243	12
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	1,421	906	684	243	12

Highest Voltage Under Normal Condition

NTDC Islamabad Region

6. 220kV Grid Station ISPR (SANGJANI)

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV ISPR - Burhan	25	43	259	102	306	–	–	235	120	232	30	–	–	236	60	200	60	204	60	190	60	196	60	195	180
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV ISPR - Tarbela	139	54	322	168	284	–	–	240	60	238	90	240	240	242	60	195	60	204	60	195	60	196	60	196	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–
Normal	220 kV ISPR - Bahria Town	181	98	269	84	266	–	–	235	180	235	90	234	120	234	60	195	60	203	60	190	60	195	60	192	180
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV ISPR - Rawat	192	101	268	84	266	–	–	235	180	235	90	232	120			198	60	200	60	190	60	195	60	192	180
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV ISPR - Mansehra Ckt I	118	116	124	72	150	–	–	238	60	235	60	236	180	240	60	195	60	205	120	196	60	198	60	195	180
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV ISPR - Mansehra Ckt II	118	58	122	72	150	–	–	238	60	235	60	236	180	240	60	195	60	205	120	196	60	198	60	195	180
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	773	470	1,364	582	1,422
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	773	470	1,364	582	1,422

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Islamabad Region

7. 220kV Grid Station MARDAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Tarbela - Mardan Ckt I & II	5730	6875	1820	1333	2093	–	–	–	–	–	–	–	–	–	–	180	60	188	60	181	60	185	60	185	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Mardan - Barotha Ckt I & II	2845	3345	–	–	NP	–	–	–	–	–	–	–	–	NP		180	60	185	120	–	–	–	–	NP	
N-1		–	–	–	–		–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–		
Normal	220 kV Mardan - Shahibagh Ckt I & II	2784	747	–	–	NP	–	–	–	–	–	–	–	–	NP		180	60	185	150	–	–	–	–	NP	
N-1		–	–	–	–		–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–		
Normal	220 kV Mardan - Nowshera Ckt I & II	–	–	1820	1333	2093	–	–	–	–	–	–	–	–	–	–	–	–	–	–	181	60	185	60	185	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Mardan - Chakdara Ckt	*	2546	1820	1333	2093	Energized * 16-Sep-2018		–	–	–	–	–	–	–	–	Energized * 16-Sep-2018		190	60	181	60	185	60	185	60
N-1			–	–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–

NP: Not provided

Total No. of Variations (Normal)	11,359	13,513	5,460	3,999	6,279
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	11,359	13,513	5,460	3,999	6,279

Lowest Voltage Under Normal Condition

NTDC Islamabad Region

8. 220kV Grid Station NOWSHERA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Nowshera - Mardan	*	Nil	338	215	767	*		Nil		240	60	238	60	238	60	*		Nil		199	30	200	60	195	60
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–
Normal	220 kV Nowshera - Barotha 1 & 2	*	Nil	689	215	767	*		Nil		240	60	238	60	238	60	*		Nil		199	30	200	60	195	60
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–
Normal	220 kV Nowshera - S. M Peshawar	*	Nil	330	198	767	*		Nil		240	60	238	60	238	60	*		Nil		199	30	200	60	195	60
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–

* Energized 19-Apr-2019

Total No. of Variations (Normal)	*	Nil	1,357	628	2,301
Total No. of Variations (N-1)			–	–	–
Total of Normal & N-1			1,357	628	2,301

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Islamabad Region

9. 220kV Grid Station NEW SHAHIBAGH PESHAWAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Shahibagh - Peshawar Ckt II	1612	1878	2103	2954	3067	–	–	–	–	–	–	–	–	–	–	190	180	190	120	182	60	184	120	182	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Shahibagh - Mardan Ckt I	1091	601	NP			–	–	–	–	NP						182	60	192	120	NP					
N-1		–	–				–	–	–	–							–	–	–	–						
Normal	220 kV Shahibagh - Chakdara	*	337	1517	1396	1703	*		–	–	–	–	–	–	–	–	*		170	60	182	60	185	60	187	60
N-1			–	–	–				–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–

* Energized 16-Sep-2018 NP: Not provided

Total No. of Variations (Normal)	806	2,703	2,816	4,350	4,770
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	806	2,703	2,816	3,620	4,770

Lowest Voltage Under Normal Condition

NTDC Islamabad Region

10. 220kV Grid Station UNIVERSITY

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltag	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV University - Rawat Ckt I & II	1634	2832	2812	2363	1469	242	60	250	60	246	240	249	120	249	60	–	–	202	60	202	120	–	–	203	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	2,832	2,812	2,541	2,363	1,469
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	2,832	2,812	2,541	2,363	1,469

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Islamabad Region

11. 220kV Grid Station MANSEHRA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Mansehra - Allai Khwar 1	1	31	14	78	46	232	150	241	60	235	120	238	180	242	60	–	–	–	–	194	60	198	50	200	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Mansehra - Allai Khwar 2	1	31	14	78	46	232	150	241	60	235	120	238	180	242	60	–	–	–	–	194	60	198	50	200	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Mansehra - ISPR 1	*	31	14	78	43	*		241	60	235	120	238	180	242	60	*		–	–	194	60	198	50	–	–
N-1			–	–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–
Normal	220 kV Mansehra - ISPR 2	*	31	14	78	43	*		241	60	235	120	238	180	242	60	*		–	–	194	60	198	50	–	–
N-1			–	–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–

* Energized Nov, 2018

Total No. of Variations (Normal)	2	124	56	312	178
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	2	124	56	312	178

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Islamabad Region

12. 220kV Grid Station CHAKDARA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Chakdara - Shahibagh	*	115	289	169	183	*		–	–	–	–	–	–	235	90	*		196	60	190	90	190	90	180	60
N-1			–	–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–		
Normal	220 kV Chakdara - Mardan	*	202	289	199	183	*		–	–	–	–	–	–	235	90	*		193	60	190	90	190	90	180	60
N-1			–	–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–		

* Energized 16-Sep-2018

Total No. of Variations (Normal)	*	317	578	368	366
Total No. of Variations (N-1)		–	–	–	–
Total of Normal & N-1		317	578	368	366

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Islamabad Region

13. 220kV Grid Station D. I. KHAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV D. I. Khan - Chashma 1	*	915	1563	921	573	*		246	60	242	120	240	180	242	120	*		–	–	–	–	–	–	–	–
N-1			–	–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–
Normal	220 kV D. I. Khan - Chashma 2	*	915	1563	921	573	*		246	60	242	120	240	180	242	120	*		–	–	–	–	–	–	–	–
N-1			–	–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–

* Energized 18-Feb-2019

Total No. of Variations (Normal)	*	1,830	3,126	1,842	1,146
Total No. of Variations (N-1)		–	–	–	–
Total of Normal & N-1		1,830	3,126	1,842	1,146

Highest Voltage Under Normal Condition

APPENDIX 2

Voltage violations data - detailed circuit wise analysis

NTDC Lahore Region

1. 500 kV Gatti
2. 500 kV Nokhar
3. 500 kV Sheikhupura
4. 500 kV New Lahore
5. 220 kV Faisalabad West
6. 220 kV Bandala
7. 220 kV Bund Road Lahore
8. 220 kV Gakkhar
9. 220 kV Ghazi Road
10. 220 kV Gujrat
11. 220 kV Jaranwala
12. 220 kV Kala Shah Kaku
13. 220 kV Ludewala
14. 220 kV Nishatabad
15. 220 kV New Kot Lakhpat
16. 220 kV New Shalamar
17. 220 kV Ravi
18. 220 kV Samundri Road
19. 220 kV Sarfraz Nagar
20. 220 kV Sialkot
21. 220 kV Toba Tek Singh
22. 220 kV WAPDA Town

NTDC Lahore Region

1. 500kV Grid Station GATTI FAISALABAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2016-17		2017-18		2018-19		2019-20		2020-21		2016-17		2017-18		2018-19		2019-20		2020-21	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Gatti - Barotha Ckt I	NA					NA										NA									
N-1																										
Normal	500 kV Gatti - Barotha Ckt II	NA				1	NA								530	60									–	–
N-1						–									–	–									–	–
Normal	500 kV Gatti - Rousch	120	22	26	30	12	540	60	538	150	540	330	540	360	540	270	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gatti - H. B. Shah 1	618	155	23	7	12	540	60	535	90	543	390	535	90	540	240	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gatti - H. B. Shah 2	252	155	232	18	39	540	90	545	30	540	690	540	390	540	570	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gatti - QATPL Bhikhi Ckt	340	8	1	1	38	540	90	530	180	533	100	530	150	540	330	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gatti - Faisalabad West					78									540	240									–	–
N-1						–									–	–									–	–
Normal	220 kV Gatti - Nishatabad 1	312	72	42	9	32	240	150	243	90	234	120	236	240	236	70	–	–	–	–	203	330	207	60	204	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Gatti - Nishatabad 2	313	72	42	9	32	240	60	243	90	234	120	236	240	236	270	–	–	–	–	203	330	207	60	204	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Gatti - Jaranwala Road 1	208	45	45	28	97	242	90	242	90	232	120	235	240	236	270	–	–	–	–	200	240	204	60	201	180
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Gatti - Jaranwala Road 2	208	45	45	28	97	241	90	242	90	232	120	235	240	236	270	–	–	–	–	200	240	204	60	201	180
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Gatti - Yousafwala 1	NA		67	NP	227	NA				231	90	NP		235	270	NA				200	60	NP		195	390
N-1				–							–	–			–	–					–	–			–	–
Normal	220 kV Gatti - Yousafwala 2	NA		67	NP	227	NA				231	90	NP		235	270	NA				200	60	NP		195	390
N-1				–							–	–			–	–					–	–			–	–
Normal	220 kV Gatti - Ludewala 1	NA		91	41	158	NA						–	–	–	–	NA				201	330	203	120	200	180
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–
Normal	220 kV Gatti - Ludewala 2	NA		91	41	158	NA						–	–	–	–	NA				201	330	203	120	200	180
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–
Normal	220 kV Gatti - Bandala 1	392	111	38	21	78	242	90	245	90	236	240	232	300	240	120	–	–	–	–	206	90	204	120	202	180
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Gatti - Bandala 2	392	111	38	21	78	242	90	245	90	236	240			240	120	–	–	–	–	206	90	204	120	202	180
N-1		–	–	–	–	–	–	–	–	–	–	–					–	–	–	–	–	–	–	–	–	–
Normal	220 kV Gatti - Lalian					39									–	–									204	180
N-1						–									–	–									–	–

Reported in 2021-22 NP: Not Provided NA: Not applicable

Total No. of Variations (Normal)	3,155	796	848	254	871
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	3,155	796	848	254	871

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

Lowest Voltage Under Normal Condition @220kV Level

NTDC Lahore Region

2. 500kV Grid Station NOKHAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Gakkhar - Rawat 1	117	77	32	28	21	535	60	535	150	537	90	536	120	534	180	450	90	465	90	472	180	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gakkhar - Rawat 2	117	77	32	28	21	535	60	535	150	537	90	536	120	534	180	450	90	465	90	472	180	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gakkhar - Sheikhupura	117	77	32	28	21	535	60	535	150	537	90	536	120	534	180	450	90	465	90	472	180	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gakkhar - New Lahore	117	77	32	28	21	535	60	535	150	537	90	536	120	534	180	450	90	465	90	472	180	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Gakkhar - Neelum Jhelum ckt 1					21									534	180									–	–
N-1						–									–	–									–	–
Normal	500 kV Gakkhar - Neelum Jhelum ckt 2					21									534	180									–	–
N-1						–									–	–									–	–
Normal	220 kV Nokhar - Gakkhar	121	215	449	245	161	232	360	236	90	241	150	240	120	238	180	200	270	200	210	197	90	202	270	201	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Gakkhar - Gujrat					161									238	120									201	120
N-1						–									–	–									–	–

Reported in 2021-22

Total No. of Variations (Normal)	710	738	577	357	245
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	710	738	577	357	245

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

Lowest Voltage Under Normal Condition @220kV level

NTDC Lahore Region

3. 500kV Grid Station SHEIKHUPURA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Sheikhupura - Nokhar Ckt	476	30	8	7	NA	539	30	532	90	528	90	528	90	NA		–	–	–	–	–	–	–	–	NA	
N-1		–	–	–	–		–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–		
Normal	500 kV Sheikhupura - CCPP Bhikhi	156	26	26	5	NA	538	30	535	60	540	60	526	120	NA		–	–	–	–	–	–	–	–	NA	
N-1		–	–	–	–		–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–		
Normal	500 kV Sheikhupura - New Lahore	476	52	5	NP	NP	541	60	535	60	528	60	NP		NP		–	–	–	–	–	–	NP		NP	
N-1		–	–	–			–	–	–	–	–	–					–	–	–	–	–	–				
Normal	500 kV Sheikhupura - HVDC ckt	Added in 2020-21			7	2	Added in 2020-21						526	90	525	60	Added in 2020-21						–	–	–	–
N-1					–	–							–	–	–	–							–	–	–	–
Normal	220 kV Sheikhupura - WTN	3846	986	283	17	52	–	–	–	–			–	–	230	60	198	30	198	60	197	90	202	60	197	60
N-1		392	30	–	–	–	–	–	–	–	–	–	–	–	–	–	189	30	192	60	–	–	–	–	–	–
Normal	220 kV Sheikhupura - NKLP Ckt I & II	2983	780	686	6	91	–	–	–	–	–	–	–	–	–	–	198	30	198	60	194	60	202	60	193	120
N-1		1175	2	–	–	–	–	–	–	–	–	–	–	–	–	–	190	30	196	60	–	–	–	–	–	–
Normal	220 kV Sheikhupura - Bund Road Ckt I, II, III & IV	12587	4509	582	57	156	–	–	–	–	–	–	–	–	232	60	194	30	198	60	197	60	202	90	200	90
N-1		4165	89	–	–	–	–	–	–	–	–	–	–	–	–	–	190	60	192	60	–	–	–	–	–	–
Normal	220 kV Sheikhupura - Ravi Ckt I & II	2845	472	436	42	31	–	–	–	–			–	–	–	–	198	30	198	60	197	60	204	90	196	150
N-1		596	2	–	–	–	–	–	–	–	–	–	–	–	–	–	189	30	197	90	–	–	–	–	–	–
Normal	220 kV Sheikhupura - ATLAS P/H	3252	1662	986	27	24	–	–	–	–			237	120	–	–	198	30	198	60	184	60	204	120	196	150
N-1		655	66	–	–	–	–	–	–	–	–	–	–	–	–	–	190	30	192	120	–	–	–	–	–	–

NP: Not Provided

Total No. of Variations (Normal)	26,621	8,517	3,012	168	356
Total No. of Variations (N-1)	6,983	189	–	–	–
Total of Normal & N-1	33,604	8,706	3,012	168	356

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

Lowest Voltage Under Normal Condition @220kV level

NTDC Lahore Region

4. 500kV Grid Station NEW LAHORE

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV New Lahore - Balloki	674	214	110	94	226	542	60	542	60	534	60	534	120	540	120	–	–	–	–	464	60	473	60	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV New Lahore - GAKKHAR	*	191	106	94	113	*		542	60	534	60	534	120	540	120	*		–	–	464	60	472	60	–	–
N-1			–	–	–	–			–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–
Normal	500 kV New Lahore - CFPP Sahiwal	**		111	93	113	**				534	60	534	120	540	120	**				464	60	473	60	–	–
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–
Normal	500 kV New Lahore - HVDC Conv 1 & 2	Added in 2020-21			93	226	Added in 2020-21						534	120	540	120	Added in 2020-21						473	60	–	–
N-1					–	–							–	–	–	–							–	–	–	–
Normal	220 kV New Lahore - Ghazi Road	**		11	202	222	**				234	150	235	60	237	60	**				207	20	202	60	200	60
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–
Normal	220 kV New Lahore - NKLP	67	643	83	201	444	–	–	240	60	235	180	235	60	237	60	203	60	198	60	203	60	202	60	200	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV New Lahore - SNR	66	627	71	NP	NP	–	–	242	60	235	180	NP		NP		203	60	198	60	203	60	NP		NP	
N-1		–	–	–			–	–	–	–	–	–					–	–	–	–	–	–				
Normal	220 kV New Lahore - Wapda Town	**		90	202	222	**				235	180	235	60	237	60	**				203	60	202	60	200	60
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–

* Added in 2018-19 ** Added in 2019-20

Total No. of Variations (Normal)	1,474	1,966	582	886	1,566
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	1,474	1,966	582	886	1,566

Highest Voltage Under Normal Condition @ 500kV level

Highest Voltage Under Normal Condition @ 220kV level

Lowest Voltage Under Normal Condition @ 220kV level

NTDC Lahore Region

5. 500kV Grid Station FAISALABAD WEST

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Fisalabad West - Gatti ckt 1					369									542	60									–	–
N-1						–									–	–									–	–
Normal	500 kV Fisalabad West - Gatti ckt 2					369									542	60									–	–
N-1						–									–	–									–	–
Normal	500 kV Fisalabad West - H. B. Shah ckt 1					369									542	60									–	–
N-1						–									–	–									–	–
Normal	500 kV Fisalabad West - H. B. Shah ckt 1					369									542	60									–	–
N-1						–									–	–									–	–
Normal	220 kV Fisalabad West - T. T. Singh					10									235	180									–	–
N-1						–									–	–									–	–
Normal	220 kV Fisalabad West - Trimmu					10									235	180									–	–
N-1						–									–	–									–	–

Added in 2021-22

Total No. of Variations (Normal)						1,496
Total No. of Variations (N-1)						–
Total of Normal & N-1						1,496

Highest Voltage Under Normal Condition @ 500kV level

Highest Voltage Under Normal Condition @ 220kV level

NTDC Lahore Region

6. 220kV Grid Station BANDALA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Bandala - KSK 1	416	298	450	260	114	240	60	–	–	241	90	240	120	–	–	–	–	199	60	202	60	201	180	190	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Bandala - KSK 2	416	298	450	260	114	236	70	–	–	241	90	240	120			–	–	199	60	202	60	201	180	190	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Bandala - Gatti 1	432	298	450	68	226	240	60	–	–	241	90	–	–	–	–	–	–	199	60	202	60	201	180	190	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Bandala - Gatti 2	419	298	450	68	2	240	60	–	–	241	90	–	–	–	–	–	–	199	60	202	60	201	180	207	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	1,683	1,192	1,800	656	456
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	1,683	1,192	1,800	656	456

Lowest Voltage Under Normal Condition

NTDC Lahore Region

7. 220kV Grid Station BUND ROAD LAHORE

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Bund Road - NKLP I & II	1202	1147	875	841	2070	–	–	–	–	–	–	–	–	–	–	182	90	184	90	188	90	198	90	184	90
N-1		97	17	10	–	22	–	–	–	–	–	–	–	–	–	–	180	90	186	270	190	150	–	–	191	90
Normal	220 kV Bund Road - KSK I & II	1287	1196	1052	904	2114	–	–	–	–	–	–	–	–	–	–	180	240	183	210	190	210	197	90	184	90
N-1		135	29	9	–	–	–	–	–	–	–	–	–	–	–	–	180	90	187	90	190	210	–	–	–	–
Normal	220 kV Bund Road - SKP I & II	1268	1119	852	833	2114	–	–	–	–	–	–	–	–	–	–	182	90	183	90	188	90	198	90	184	90
N-1		115	21	11	–	–	–	–	–	–	–	–	–	–	–	–	180	90	187	90	192	150	–	–	–	–
Normal	220 kV Bund Road - SKP III & IV	1270	1119	874	842	2114	–	–	–	–	–	–	–	–	–	–	182	120	184	90	188	90	198	90	184	90
N-1		128	16	11	–	–	–	–	–	–	–	–	–	–	–	–	184	90	188	90	192	150	–	–	–	–

Total No. of Variations (Normal)	5,027	4,581	3,653	3,420	8,412
Total No. of Variations (N-1)	475	83	41	–	–
Total of Normal & N-1	5,502	4,664	3,694	3,420	8,412

Lowest Voltage Under Normal Condition

Lowest Voltage Under N-1 Condition

NTDC Lahore Region

8. 220kV Grid Station GAKKHAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Gakkhar - Mangla Ckt	1335	1606	1133	990	756	–	–	–	–	–	–	–	–	–	–	189	60	188	60	189	60	187	60	191	120
N-1		4	12	19	–	–	–	–	–	–	–	–	–	–	–	–	190	60	190	60	188	60	–	–	–	–
Normal	220 kV Gakkhar - Sialkot	1360	1626	1147	1016	770	–	–	–	–	–	–	–	–	–	–	191	60	183	60	189	60	187	60	191	120
N-1		11	19	19	–	–	–	–	–	–	–	–	–	–	–	–	190	60	186	60	186	60	–	–	–	–
Normal	220 kV Old Gakkhar - New Gakkhar (Nokhar)	1917	1898	895	1299	1000	–	–	–	–	–	–	–	–	–	–	191	60	181	60	188	60	185	60	189	120
N-1		–	31	19	–	–	–	–	–	–	–	–	–	–	–	–	190	60	184	60	184	60	–	–	–	–
Normal	220 kV Gakkhar - Gujrat	1917	1898	895	1299	1000	–	–	–	–	–	–	–	–	–	–	191	60	181	60	188	60	185	60	189	120
Normal		–	31	19	–	–	–	–	–	–	–	–	–	–	–	–	190	60	184	60	184	60	–	–	–	–

NP: Not Provided

Total No. of Variations (Normal)	6,529	7,028	4,070	4,604	3,526
Total No. of Variations (N-1)	15	93	76	–	–
Total of Normal & N-1	6,544	7,121	4,146	4,604	3,526

Lowest Voltage Under Normal Condition

NTDC Lahore Region

9. 220kV Grid Station GHAZI ROAD LAHORE

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2020-21	2017-18		2018-19		2019-20		2020-21		2021-22		2016-17		2017-18		2018-19		2019-20		2020-21	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Ghazi - Shalamar	2539	2505	1745	3225	3037	–	–	–	–	–	–	–	–	–	–	178	60	170	60	195	60	180	120	176	60
N-1		39	672	1765	–	–	–	–	–	–	–	–	–	–	–	–	190	50	174	60	168	60	–	–	–	–
Normal	220 kV Ghazi - KSK	2539	2229	1745	3225	3037	–	–	–	–	–	–	–	–	–	–	178	60	170	60	195	180	180	120	176	60
N-1		39	1484	1765	–	–	–	–	–	–	–	–	–	–	–	–	190	50	173	60	168	60	–	–	–	–
Normal	220 kV KSK - New Lahore	Added in 2019-20		771	3201	3035	Added in 2019-20				–	–	–	–	–	–	Added in 2019-20				198	180	180	120	176	60
N-1				185	–	–					–	–	–	–	–	–					184	60	–	–	–	–
Normal	220 kV Ghazi - Sarfaraznagar	Added in 2019-20			3211	2976	Added in 2019-20						–	–	–	–	Added in 2019-20						180	120	176	60
N-1					–	–							–	–	–	–							–	–	–	–

NA: Not Applicable

Total No. of Variations (Normal)	2,539	4,734	4,261	12,862	12,085
Total No. of Variations (N-1)	39	2,156	3,715	–	–
Total of Normal & N-1	2,578	6,940	7,976	12,862	12,085

Lowest Voltage Under Normal Condition

NTDC Lahore Region

10. 220kV Grid Station GUJRAT

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Gujrat - Old Gakkhar	1211	2815	876	1087	924	234	60	238	60	241	60	239	60	239	60	190	60	189	60	193	60	191	150	187	30
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Gujrat - New Gakkhar	1199	777	880	1084	924	234	60	238	120	241	60	239	60	239	60	190	60	191	60	193	60	191	150	187	30
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Gujrat - Mangla 1 & 2	1201	1809	876	1123	1848	234	60	238	60	241	60	239	60	239	60	190	60	189	60	193	60	189	60	187	30
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	3,611	5,401	2,632	3,294	3,696
Total No. of Variations (N-1)	–	–	–	–	
Total of Normal & N-1	3,611	5,401	2,632	3,294	3,696

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Lahore Region

11. 220kV Grid Station JARANWALA ROAD FAISALABAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Jaranwala - Gatti Ckt I & II	836	340	661	52	268	246	38	238	90	242	62	234	35	–	–	–	–	–	–	–	–	206	159	202	70
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	836	340	661	52	268
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	836	340	661	52	268

Lowest Voltage Under Normal Condition

NTDC Lahore Region

12. 220kV Grid Station KALA SHAH KAKU

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Kala Shah Kaku - Mangla Ckt I, II & III	702	680	639	859	1860	–	–	–	–	–	–	–	–	–	–	185	90	180	120	–	–	184	150	181	150
N-1		48	66	101	–	153	–	–	–	–	–	–	–	–	–	–	180	90	180	60	–	–	–	–	185	90
Normal	220 kV Kala Shah Kaku - Bund Road Ckt I & II	777	768	560	622	1110	–	–	–	–	–	–	–	–	–	–	185	90	184	90	184	90	188	60	188	90
N-1		52	88	117	–	62	–	–	–	–	–	–	–	–	–	–	180	60	187	90	180	90	–	–	189	150
Normal	220 kV Kala Shah Kaku - Ravi Ckt I & II	737	756	639	972	638	–	–	–	–	–	–	–	–	–	–	184	120	184	90	184	90	173	90	174	150
N-1		56	86	115	–	57	–	–	–	–	–	–	–	–	–	–	185	90	180	90	181	90	–	–	184	90
Normal	220 kV Kala Shah Kaku - Sialkot	710	735	596	628	579	–	–	–	–	–	–	–	–	–	–	184	90	183	60	187	90	188	90	150	90
N-1		56	78	117		44	–	–	–	–	–	–	–	–	–	–	185	60	181	90	180	90	–	–	188	90
Normal	220 kV Kala Shah Kaku - Bandala Ckt I & II	592	566	457	600	1115	–	–	–	–	–	–	–	–	–	–	184	60	187	120	189	120	189	150	185	60
N-1		45	77	73	–	31	–	–	–	–	–	–	–	–	–	–	185	60	187	90	188	120	–	–	189	90
Normal	220 kV Kala Shah Kaku - Ghazi Rd	407	766	672	773	751	–	–	–	–	–	–	–	–	–	–	188	60	180	60	185	150	180	60	150	90
N-1		7	88	133	–	71	–	–	–	–	–	–	–	–	–	–	190	90	180	90	181	90	–	–	185	90

NP: Not Provided

*Energized 18-Oct-2017

Total No. of Variations - Normal	4,308	4,271	3,563	4,454	6,053
Total No. of Variations - N-1	321	483	656	–	418
Total of Normal & N-1	4,629	4,754	4,219	4,454	6,471

Lowest Voltage Under Normal Condition

Lowest Voltage Under N-1 Condition

NTDC Lahore Region

13. 220kV Grid Station LUDEWALA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Gatti - Ludewala Ckt I & II	282	243	210	75	402	242	60	240	240	240	120	240	240	239	60	–	–	198	60	198	60	204	120	200	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Chashma - Ludewala Ckt I & II	307	133	201	82	354	236	60	238	120	238	120	240	210	238	120	198	60	–	–	198	90	202	60	199	60
N-1		1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	197	120	–	–	–	–	–	–	–	–
Normal	220 kV Gatti - Lalian Ckt					1									–	–									208	60
N-1						–									–	–									–	–

Reported in 2021-22

Total No. of Variations (Normal)	589	376	411	157	757
Total No. of Variations (N-1)	1	–	–	–	–
Total of Normal & N-1	590	376	411	157	757

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Lahore Region

14. 220kV Grid Station NISHATABAD FAISALABAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Nishatabad - Gatti Ckt I	22	12	67	14	3	238	120	234	120	–	–	235	90	235	60	–	–	–	–	203	60	–	–	–	–
N-1		10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	183	30	–	–	–	–	–	–	–	–
Normal	220 kV Nishatabad - Gatti Ckt II	22	12	67	14	3	238	120	234	120	–	–	235	90	235	60	–	–	–	–	203	60	–	–	–	–
N-1		10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	183	30	–	–	–	–	–	–	–	–
Normal	220 kV Nishatabad - Samundri Road Ckt I	22	12	67	–	3	238	120	234	120	–	–	–	–	235	60	–	–	–	–	203	60	–	–	–	–
N-1		10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	183	30	–	–	–	–	–	–	–	–
Normal	220 kV Nishatabad - Samundri Road Ckt II	22	12	67	–	3	238	120	234	120	–	–	–	–	235	60	–	–	–	–	203	60	–	–	–	–
N-1		10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	183	30	–	–	–	–	–	–	–	–

NA: Not Applicable

Total No. of Variations (Normal)	88	48	268	28	12
Total No. of Variations (N-1)	40	–	–	–	–
Total of Normal & N-1	128	48	268	28	12

Highest Voltage Under Normal Condition

NTDC Lahore Region

15. 220kV Grid Station NEW KOT LAKHPAT

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV NKLP - BDR - 1	933	610	1042	1147	889	–	–	–	–	–	–	–	–	–	–	180	150	185	150	185	90	185	90	180	150
N-1		49	28	–	–	6	–	–	–	–	–	–	–	–	–	–	187	90	185	90	–	–	–	–	–	–
Normal	220 kV NKLP - BDR - 2	933	610	1042	1147	889	–	–	–	–	–	–	–	–	–	–	180	150	185	150	185	90	185	90	180	150
N-1		49	28	–	–	6	–	–	–	–	–	–	–	–	–	–	187	90	185	90	–	–	–	–	–	–
Normal	220 kV NKLP - SKP Ckt	563	442	479	1059	975	–	–	236	190	235	90	–	–	–	–	184	150	191	90	190	90	186	90	182	90
N-1		15	8	–	–	–	–	–	–	–	–	–	–	–	–	–	192	90	195	90	–	–	–	–	–	–
Normal	220 kV NKLP - SNR Ckt	731	539	474	691	582	–	–	–	–	–	–	–	–	–	–	184	90	187	90	195	150	187	150	185	90
N-1		16	15	–	–	–	–	–	–	–	–	–	–	–	–	–	189	150	190	90	–	–	–	–	–	–
Normal	220 kV NKLP - New Lahore Ckt I & II	220	813	785	691	1302	–	–	–	–	–	–	–	–	–	–	192	150	187	90	191	90	188	90	181	90
N-1		29	12	–	–	–	–	–	–	–	–	–	–	–	–	–	190	90	191	90	–	–	–	–	–	–

Total No. of Variations (Normal)	4,094	3,542	3,822	4,735	4,637
Total No. of Variations (N-1)	191	104	–	–	12
Total of Normal & N-1	4,285	3,646	3,822	4,735	4,649

Lowest Voltage Under Normal Condition

NTDC Lahore Region

16. 220kV Grid Station NEW SHALAMAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Shalamar - Ravi	827	728	718	949	996	–	–	–	–	–	–	–	–	–	–	182	60	183	90	186	90	182	120	178	90
N-1		155	175	278	–	–	–	–	–	–	–	–	–	–	–	–	178	60	180	90	183	90	–	–	–	–
Normal	220 kV Shalamar - Ghazi Rd	598	619	563	953	901	–	–	–	–	–	–	–	–	–	–	184	90	183	90	186	90	182	120	180	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

NP: Not Provided

Total No. of Variations (Normal)	1,618	1,347	1,281	1,902	1,897
Total No. of Variations (N-1)	159	175	278	–	–
Total of Normal & N-1	1,777	1,522	1,559	1,902	1,897

Lowest Voltage Under Normal Condition

NTDC Lahore Region

17. 220kV Grid Station RAVI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Ravi - Atlas	426	587	558	492	743	–	–	232	90	–	–	–	–	–	–	191	90	188	90	188	90	194	90	191	150
N-1		45	4	4	–	–	–	–	–	–	–	–	–	–	–	–	188	90	190	90	190	90	–	–	–	–
Normal	220 kV Ravi - KSK	856	1181	1258	697	994	–	–	–	–	–	–	–	–	–	–	190	270	190	90	180	90	193	90	190	210
N-1		49	–	–	–	–	–	–	–	–	–	–	–	–	–	–	191	180	–	–	–	–	–	–	–	–
Normal	220 kV Ravi - SKP	553	527	500	406	710	–	–	–	–	–	–	–	–	–	–	187	60	183	90	190	90	192	210	188	150
N-1		25	4	–			–	–	–	–	–	–	–	–	–	–	190	90	192	90	–	–	–	–	–	–
Normal	220 kV Ravi - SMR	800	974	1161	620	1046	–	–	–	–	–	–	–	–	–	–	190	90	180	60	180	60	195	90	186	90
N-1		54	4	7	–	–	–	–	–	–	–	–	–	–	–	–	190	60	190	60	190	60	–	–	–	–

Total No. of Variations (Normal)	3,471	4,450	3,477	2,215	3,493
Total No. of Variations (N-1)	222	12	11	–	–
Total of Normal & N-1	3,693	4,462	3,488	2,215	3,493

Lowest Voltage Under Normal Condition

NTDC Lahore Region

18. 220kV Grid Station SAMUNDRI ROAD FAISALABAD

Condition	Name of Transmission Circuits voilating the Voltage Criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Samundri Road - Nishatabad Ckt I	36	7	201	100	288	241	150	241	150	239	90	241	210	242	180	200	330	–	–	205	210	204	90	204	210
N-1		3	6	1	–	–	–	–	–	–	–	–	–	–	–	–	190	120	180	90	179	90	–	–	–	–
Normal	220 kV Samundri Road - Nishatabad Ckt II	36	7	201	100	288	241	150	241	150	239	90	241	120	242	180	200	330	–	–	205	210	204	90	204	210
N-1		3	6	1	–	–	–	–	–	–	–	–	–	–	–	–	190	120	180	90	179	90	–	–	–	–
Normal	220 kV Samundri Road - T.T Singh Ckt I&II	36	7	201	24	976	241	150	241	150	239	90	238	120	242	180	200	330	–	–	205	210	204	90	204	210
N-1		3	6	1	–	–	–	–	–	–	–	–	–	–	–	–	190	120	180	90	179	90	–	–	–	–

Total No. of Variations (Normal)	144	28	603	224	1552
Total No. of Variations (N-1)	12	24	3	–	–
Total of Normal & N-1	156	52	606	224	1552

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Lahore Region

19. 220kV Grid Station SARFRAZ NAGAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV SNR - NKLP Ckt	667	630	814	1556	1853	–	–	–	–	–	–	–	–	–	–	195	90	190	510	178	270	176	210	172	120
N-1		6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	185	90	–	–	–	–	–	–	–	–
Normal	220 kV SNR - Okara Ckt I & II	670	643	818	1518	1877	–	–	–	–	–	–	–	–	–	–	185	90	190	510	178	270	176	210	172	120
N-1		4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	190	510	–	–	–	–	–	–	–	–
Normal	220 kV SNR - New Lahore	*	643	475	NP	1877	*		–	–	–	–	–	–	–	–	*		190	510	195	570	NP		172	120
N-1			–	–					–	–	–	–	–	–	–	–			–	–	–	–			–	–
Normal	220 kV SNR - Ghazi Road	**		345	1532	1853	**				–	–	–	–	–	–	**				178	270	176	210	172	120
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–

NP: Not Provided * Added in 2018-19 ** Added in 2019-20

Total No. of Variations (Normal)	1,337	2,948	2,546	4,606	7,460
Total No. of Variations (N-1)	10	20	–	–	–
Total of Normal & N-1	1,347	2,968	2,546	4,606	7,460

Lowest Voltage Under Normal Condition

NTDC Lahore Region

20. 220kV Grid Station SIALKOT

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Sialkot - Gakkhar	1183	1219	1224	1174	1410	–	–	–	–	–	–	–	–	–	–	180	390	170	150	180	90	180	330	180	330
N-1		4	–	–	–	4	–	–	–	–	–	–	–	–	–	–	188	90	–	–	–	–	–	–	190	150
Normal	220 kV Sialkot - KSK	1163	1200	1195	1176	1409	–	–	–	–	–	–	–	–	–	–	180	210	170	150	180	150	180	210	180	330
N-1		2	6	1	–	10	–	–	–	–	–	–	–	–	–	–	180	90	160	90	190	90	–	–	190	540

Total No. of Variations (Normal)	2,346	2,421	2,419	2,350	2,819
Total No. of Variations (N-1)	6	4	1	–	14
Total of Normal & N-1	2,352	2,425	2,420	2,350	2,833

Lowest Voltage Under Normal Condition

Lowest Voltage Under N-1 Condition

NTDC Lahore Region

21. 220kV Grid Station TOBA TEK SINGH

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV T.T. Singh - Multan Ckt I & II	455	707	468	224	906	243	450	248	570	245	660	247	1110	251	570	180	870	170	480	171	1410	182	540	176	1260
N-1		–	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	177	1290	172	1410	–	–	–	–
Normal	220 kV T.T. Singh - Samundri Road Ckt I & II	455	707	468	224	906	243	450	248	570	245	660	247	1110	251	570	180	870	170	480	171	1410	182	540	176	1260
N-1		–	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	177	1290	172	1410	–	–	–	–
Normal	220 kV T.T. Singh - Multan Ckt I, II & III					1359									251	570	180	870							176	1260
N-1						–									–	–	–	–							–	–

Reported in 2021-22

Total No. of Variations (Normal)	910	1414	936	448	3171
Total No. of Variations (N-1)	–	4	4	–	–
Total of Normal & N-1	910	1418	940	448	3171

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Lahore Region

22. 220kV Grid Station WAPDA TOWN LAHORE

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2020-21	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV WTN - Sheikhupura	963	681	518	639	485	–	–	–	–	–	–	–	–	–	–	180	90	180	90	193	90	190	90	187	90
N-1		9	2	–	–	–	–	–	–	–	–	–	–	–	–	–	191	150	194	150	–	–	–	–	–	–
Normal	220 kV WTN - New Lahore	Added in 2019		441	599	452	Added in 2019				–	–	–	–	–	–	Added in 2019				193	90	190	90	188	90
N-1				1	–	–					–	–	–	–	–	–					207	90	–	–	–	–

NP: Not provided

Total No. of Variations - Normal	2,017	1,388	959	1,238	937
Total No. of Variations - N-1	22	4	1	–	–
Total of Normal & N-1	2,039	1,392	960	1,238	937

Lowest Voltage Under Normal Condition

APPENDIX 3

Voltage violations data - detailed circuit wise analysis

NTDC Multan Region

1. 500 kV D. G. Khan
2. 500 kV Multan
3. 500 kV Muzaffargarh
4. 500 kV Yousafwala
5. 500 kV Rahim Yar Khan
6. 220 kV Bahawalpur
7. 220 kV Kassowal
8. 220 kV Muzaffargarh
9. 220 kV Okara
10. 220 kV Vehari
11. 220 kV Chishtian
12. 220 kV Lal Sohanra

NTDC Multan Region

1. 500kV Grid Station D.G. KHAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV D.G. Khan - Guddu	26	20	39	21	18	575	60	561	60	565	60	560	60	564	60	–	–	–	–	494	60	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV D.G. Khan - Multan	1	20	38	8	NP	554	30	561	60	565	60	560	60	NP	NP	–	–	–	–	494	60	–	–	NP	NP
N-1		–	–	–	–	NP	–	–	–	–	–	–	–	–	NP	NP	–	–	–	–	–	–	–	–	NP	NP
Normal	220 kV D.G. Khan - Loralai I	NP	77	74	78	100	NP		251	60	252	60	250	60	252	60	NP		NP		–	–	–	–	–	–
N-1			–	–	–	–			–	–	–	–	–	–	–	–					–	–	–	–	–	–
Normal	220 kV D.G. Khan - Loralai II	NP	77	74	78	100	NP		251	60	252	60	250	60	252	60	NP		NP		–	–	–	–	–	–
N-1			–	–	–	–			–	–	–	–	–	–	–	–					–	–	–	–	–	–
Normal	500 kV D.G. Khan - Muzaffargarh	Reported in 2021-22				5	Reported in 2021-22								559	60	Reported in 2021-22								–	–
N-1						–									–	–									–	–

NP: Not Provided

Total No. of Variations (Normal)	27	194	225	185	223
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	27	194	225	185	223

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

NTDC Multan Region

2. 500kV Grid Station MULTAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Multan - Muzaffargarh	NIL	3	NIL	NA	NIL	NIL		560	30	NIL		NA		NIL		NIL		–	–	NIL		NA		NIL	
N-1			–						–	–									–	–						
Normal	500 kV Multan - Yousafwala	NP		–	NP	NP	NP				–	–	NP		NP		NP				–	–	NP		NP	
N-1				–							–	–									–	–				
Normal	500 kV Multan - Rousch	NP	3	–	NP	NP	NP		550	30	–	–	NP		NP		NP		–	–	–	–	NP		NP	
N-1			–	–					–	–	–	–							–	–	–	–				
Normal	500 kV Multan - D.G. Khan	NP	3	NIL	NP	NP	NP		547	30	NIL		NP		NP		NP		–	–	NIL		NP		NP	
N-1			–						–	–									–	–						
Normal	500 kV Multan - R Y Khan	*	3	NIL	NA	NIL	*		565	30	NIL		NA		NIL		*		–	–	NA		NA		NIL	
N-1			–						–	–									–	–						
Normal	500 kV Multan - HBS	**	3	–	NP	NP	**		560	30	–	–	NP		NP		**		–	–	–	–	NP		NP	
N-1			–	–					–	–	–	–							–	–	–	–				
Normal	220 kV Multan - Muzaffargarh 1	NP		2	NA	NIL	NP				–	–	NA		NIL		NP				207	570	NA		NIL	
N-1				–							–	–									–	–				
Normal	220 kV Multan - Muzaffargarh 2	NP		–	6	6	NP				–	–	252	180	249	240	NP				–	–	–	–	–	–
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–
Normal	220 kV Multan - Muzaffargarh 3	NP		1	3	4	NP				–	–	NA		–	–	NP				207	240	NA		208	450
N-1				–	–	–					–	–			–	–					–	–			–	–
Normal	220 kV Multan - Muzaffargarh 4	NP		2	NA	NIL	NP				–	–	NA		NIL		NP				207	570	NA		NIL	
N-1				–							–	–									–	–				
Normal	220 kV Multan - Kapco 3	NP		3	14	NIL	NP				251	90	252	150	NIL		NP				–	–	–	–	NIL	
N-1				–	–						–	–	–	–							–	–	–	–		
Normal	220 kV Multan - Kapco 4	NP		3	14	NIL	NP				251	90			NIL		NP				–	–	–	–	NIL	
N-1				–	–						–	–	–	–							–	–	–	–		
Normal	220 kV Multan - Kapco 5 & 6	NP		NIL	NA	2	NP				NIL		NA		247	270	NP				NIL		NA		–	–
N-1						–									–	–									–	–
Normal	220 kV Multan - NGPS 1 & 2	NP		1	2	NIL	NP				–	–	246	90	NIL		NP				208	120	–	–	NIL	
N-1				–	–						–	–	–	–							–	–	–	–		
Normal	220 kV Multan - Vehari 1 & 2	NP		9	12	6	NP				250	210	250	290	250	240	NP				208	60	–	–	–	–
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–
Normal	220 kV Multan - T.T. Singh 1 & 2	NP		1	4	6	NP				–	–	246	90	245	300	NP				208	60	–	–	–	–
N-1				–	–	–					–	–	–	–	–	–					–	–	–	–	–	–

NP: Not Provided * Commisssioned in Feb 2018 ** Added in 2018

Total No. of Variations (Normal)	NIL	20	22	55	24
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	NIL	20	22	55	24

Highest Voltage Under Normal Condition @220kV level

Lowest Voltage Under Normal Condition @220kV level

NTDC Multan Region

3. 500kV Grid Station MUZAFFARGARH

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2016-17	2017-18	2018-19	2019-20	2020-21	2016-17		2017-18		2018-19		2019-20		2020-21		2016-17		2017-18		2018-19		2019-20		2020-21	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Muzaffargarh - Gatti	NIL	NP	NA		NIL	NIL		NP		NA				NIL		NIL		NP		NA				NIL	
N-1																										
Normal	500 kV Muzaffargarh - Guddu	NIL					NIL										NIL									
N-1																										
Normal	500 kV Muzaffargarh - Multan	NIL	NP	NA		NIL	NIL		NP		NA				NIL		NIL		NP		NA				NIL	
N-1																										
Normal	220 kV 500kV Grid Station TPS Phase-I - Muzaffargarh	NIL	NP	NA		NIL	NIL		NP		NA				NIL		NIL		NP		NA				NIL	
N-1																										
Normal	220 kV 500kV Grid Station TPS Phase-II - Muzaffargarh	NIL	NP	NA		NIL	NIL		NP		NA				NIL		NIL		NP		NA				NIL	
N-1																										
Normal	500 kV Muzaffargarh - Guddu 747	NIL	NP	NA		NIL	NIL		NP		NA				NIL		NIL		NP		NA				NIL	
N-1																										
Normal	220 kV Muzaffargarh- D.G Khan	Added in 2019		NA		NIL	Added in 2019				NA				NIL		Added in 2019				NA				NIL	
N-1																										

NP: Not Provided NA: Not Applicable

Total No. of Variations (Normal)	NIL/NP	NA	NIL
Total No. of Variations (N-1)			
Total of Normal & N-1			

NTDC Multan Region

4. 500kV Grid Station YOUSAFWALA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Yousafwala - Lahore	NP		–	NP	NP	NP				–	–	NP		NP		NP				–	–	NP		NP	
N-1				–							–	–									–	–				
Normal	500 kV Yousafwala - Multan	207	500	693	NP	441	544	120	541	180	552	120	NP		539	60	–	–	–	–	–	–	NP		–	–
N-1		–	–	–		–	–	–	–	–	–	–			–	–	–	–	–	–	–	–			–	–
Normal	500 kV Yousafwala - CFPP	204	554	184	NP	671	543	180	542	180	–	–	NP		542	60	–	–	–	–	–	–	NP		–	–
N-1		–	–	–		–	–	–	–	–	–	–			–	–	–	–	–	–	–	–			–	–
Normal	220 kV Yousafwala - SNR	NP		–	NP	NP	NP				–	–	NP		NP		NP				–	–	NP		NP	
N-1				–							–	–									–	–				
Normal	220 kV Yousafwala - Gatti	49	156	167	NP	1680	238	180	239	120	238	120	NP		239	60	–	–	–	–	200	120	NP		196	120
N-1		–	–	–		–	–	–	–	–	–	–			–	–	–	–	–	–	–	–			–	–
Normal	220 kV Yousafwala - Kassowal	40	94	158	NP	1726	236	180	237	120	236	120	NP		237	60	–	–	198	120	198	120	NP		194	120
N-1		–	–	–		–	–	–	–	–	–	–			–	–	–	–	–	–	–	–			–	–
Normal	220 kV Yousafwala - CFPP	43	NP	–	NP	NP	543	180	NP		–	–	NP		NP		–	–	NP		–	–	NP		NP	
N-1		–		–			–	–			–	–					–	–			–	–				
Normal	220 kV Yousafwala - Okara		297	118	NP	1606			236	180	237	120	NP		238	60			198	120	199	120	NP		195	120
N-1			–	–		–			–	–	–	–			–	–			–	–	–	–			–	–

NP: Not Provided

Total No. of Variations (Normal)	543	1,601	1,320	NP	6,124
Total No. of Variations (N-1)	–	–	–		–
Total of Normal & N-1	543	1,601	1,320		6,124

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

Lowest Voltage Under Normal Condition @220kV level

NTDC Hyderabad Region

5. 500kV Grid Station RAHIM YAR KHAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Guddu 747 - RY Khan	NIL	3	NIL	NA	NIL	NIL		565	30	NIL		NA		NIL		NIL		565	30	NIL		NA		NIL	
N-1			–						–	–									–	–						
Normal	500 kV Multan - RY Khan	NIL	3	NIL	NA	NIL	NIL		565	30	NIL		NA		NIL		NIL		565	30	NIL		NA		NIL	
N-1			–						–	–									–	–						

NA: Not Applicable

Total No. of Variations (Normal)	NIL	6	NIL	NA	NIL
Total No. of Variations (N-1)		–			
Total of Normal & N-1		6			

NTDC Multan Region

6. 220kV Grid Station BAHAWALPUR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Bahawalpur - TPS Muzaffargarh Ckt I & II	21	657	806	660	948	242	180	242	30	242	180	252	30	242	120	197	30	–	–	197	30	–	–	195	30
N-1		–	179	226	108	200	–	–	251	60	252	90	247	60	250	120	–	–	–	–	190	30	192	30	196	60
Normal	220 kV Bahawalpur - Lal Sohanra Ckt I & II	21	657	505	59	306	242	180	242	30	242	30	240	60	241	90	197	30	–	–	197	30	201	60	195	30
N-1		–	179	136	6	48	–	–	251	60	250	90	245	30	–	–	–	–	–	–	190	30	195	30	196	60

Total No. of Variations (Normal)	21	657	1311	719	1254
Total No. of Variations (N-1)	–	179	362	114	248
Total of Normal & N-1	21	836	1673	833	1502

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

Highest Voltage Under N-1 Condition

Lowest Voltage Under N-1 Condition

NTDC Multan Region

7. 220kV Grid Station KASSOWAL

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2021-21		2021-22		2017-18		2018-19		2019-20		2021-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	Kassowal - Vehari 1	248	318	273	36	300	243	120	250	60	242	60	239	60	244	60	197	60	–	–	197	60	197	60	188	60
N-1		1	12	2	–	–	243	150	–	–	–	–	–	–	–	–	–	–	192	60	193	60	–	–	–	–
Normal	Kassowal - Vehari 2	248	318	273	36	300	243	120	250	60	242	60	239	60	244	60	197	60	–	–	197	60	197	60	188	60
N-1		1	12	2	–	–	243	150	–	–	–	–	–	–	–	–	–	–	192	60	193	60	–	–	–	–
Normal	Kassowal - Yousafwala 1	248	299	273	36	300	243	150	250	60	242	60	239	60	244	60	197	60	197	60	197	60	197	60	188	60
N-1		2	8	2	–	–	–	–	–	–	–	–	–	–	–	–	189	90	192	60	193	60	–	–	–	–
Normal	Kassowal - Yousafwala 2	248	299	273	36	300	243	150	250	60	242	60	239	60	244	60	197	60	197	60	197	60	197	60	188	60
N-1		2	8	2	–	–	–	–	–	–	–	–	–	–	–	–	189	90	192	60	193	60	–	–	–	–

Total No. of Variations (Normal)	998	1,234	1,092	144	1,200
Total No. of Variations (N-1)	–	40	8	–	–
Total of Normal & N-1	998	1,274	1,100	144	1,200

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Multan Region

8. 220kV Grid Station MUZAFFARGARH

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Muzaffargarh - Multan	276	207	179	164	150	244	120	244	60	242	210	248	60	241	540	–	–	–	–	–	–	–	–	–	–
N-1		–	28	29	–	81	–	–	250	270	247	120	–	–	250	300	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Muzaffargarh - TPS	374	199	179	165	162	245	180	244	60	245	60	248	60	247	540	–	–	–	–	–	–	–	–	–	–
N-1		–	29	29	–	69	–	–	250	270	247	120	–	–	250	300	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	650	406	358	329	312
Total No. of Variations (N-1)	–	57	58	–	150
Total of Normal & N-1	650	463	416	329	312

Highest Voltage Under Normal Condition

Highest Voltage Under N-1 Condition

NTDC Multan Region

9. 220kV Grid Station OKARA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Okara - Sarfaraznagar Ckt I & II	44	221	204	100	300	237	240	–	–	241	390	–	–	237	240	–	–	195	1380	195	1440	195	1440	186	1440
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Okara - Yousafwala Ckt I & II	44	221	204	104	306	237	240	–	–	241	390	–	–	237	240	–	–	195	1380	195	1440	195	1440	186	1440
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

* Proper in out energized on 19.12.2017

Total No. of Variations (Normal)	364	884	408	204	606
Total No. of Variations (N-1)	1	–	–	–	–
Total of Normal & N-1	365	884	408	204	606

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Multan Region

10. 220kV Grid Station VEHARI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Vehari - Multan Ckt I & II	1640	2074	900	639	616	242	270	–	–	243	210	249	270	241	270	196	30	135	90	195	60	–	–	190	210
N-1		140	228	99	3	257	248	150	–	–	245	270	241	270	247	150	190	30	191	30	190	90	–	–	190	210
Normal	220 kV Vehari - Kassowal Ckt I & II	1638	2081	900	633	668	242	150	–	–	243	210	249	270	242	270	196	30	198	30	195	60	–	–	190	210
N-1		140	228	101	5	213	248	150	–	–	245	270	241	270	247	150	190	30	191	30	190	90	–	–	–	–
Normal	220 kV Vehari - Chishtian Ckt I & II	1637	1821	772	377	464	243	90	–	–	–	–	249	270	241	270	194	30	198	30	–	–	–	–	190	210
N-1		140	228	98	2	61	247	150	–	–	–	–	241	41	247	150	191	30	190	30	–	–	–	–	–	–

NP: Not Provided

Total No. of Variations - Normal	4,915	5,975	2,572	1,649	1,748
Total No. of Variations - N-1	420	684	298	10	531
Total of Normal & N-1	5,335	6,659	2,870	1,659	2,279

Highest Voltage Under Normal Condition

Highest Voltage Under N-1 Condition

Lowest Voltage Under Normal Condition

Lowest Voltage Under N-1 Condition

NTDC Multan Region

11. 220kV Grid Station CHISHTIAN

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Chishtian - Vehari Ckt I & II	3282	3944	3923	2389	4192	241	90	–	–	242	90	249	150	246	120	199	120	198	60	197	30	194	120	182	30
N-1		505	817	944	83	862	249	30	–	–	250	30	247	30	245	30	173	30	189	30	190	60	–	–	179	60

Total No. of Variations (Normal)	3,282	3,944	3,923	2,389	4,192
Total No. of Variations (N-1)	505	817	944	83	862
Total of Normal & N-1	3,787	4,761	4,867	2,472	5,054

Highest Voltage Under Normal Condition

Highest Voltage Under N-1 Condition

Lowest Voltage Under Normal Condition

NTDC Multan Region

12. 220kV Grid Station LAL SOHANRA

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Lal Sohanra - BWP Ckt I & II	Added in 2019		631	167	188	Added in 2019				242	90	250	60	248	30	Added in 2019				197	30	–	–	202	60
N-1				100	41	14					250	30	250	30	245	60					190	60	194	60	–	–

Total No. of Variations (Normal)	Added in 2019	631	167	188
Total No. of Variations (N-1)		100	41	14
Total of Normal & N-1		731	208	202

Highest Voltage Under Normal Condition

Highest Voltage Under N-1 Condition

Lowest Voltage Under N-1 Condition

APPENDIX 4

Voltage violations data - detailed circuit wise analysis

NTDC Hyderabad Region

1. 500 kV Dadu
2. 500 kV Guddu
3. 500 kV Jamshoro
4. 220 kV NKI
5. 500 kV Shikarpur
6. 220 kV Dharki
7. 220 kV Hala Road
8. 220 kV Khuzdar
9. 220 kV Loralai
10. 220 kV Quetta Industrial-II
11. 220 kV Rohri
12. 220 kV Sibbi
13. 220 kV T. M. Khan Road
14. 220 kV Jhimpir
15. 220 kV Dera Murad Jamali

NTDC Hyderabad Region

1. 500kV Grid Station DADU

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2016-17		2017-18		2018-19		2019-20		2020-21	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Dadu - Jamshoro I	15	7	6	3	1	535	60	542	60	535	60	535	60	530	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Dadu - Jamshoro II	15	7	NA	NP		535	60	542	60	NA		NP				–	–	–	–	NA		NP			
N-1		–	–				–	–	–	–							–	–	–	–						
Normal	500 kV Dadu - Guddu I	NP		–	NP		NP				–	–	NP				NP				–	–	NP			
N-1				–							–	–									–	–				
Normal	500 kV Dadu - Guddu II	5	***				535	60	***								–	–	***							
N-1		–					–	–									–	–								
Normal	500 kV Dadu - Shikarpur I	15	10	6	3	1	535	120	542	60	535	60	535	60	530	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Dadu - Shikarpur II	10	10	6	3	1	535	120	542	60	535	60	535	60	530	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Dadu - Port Qasim	*	NA	6	2	NP	*		NA		535	60	530	60	NP		*		NA		–	–	–	–	NP	
N-1				–	–						–	–	–	–							–	–	–	–		
Normal	500 kV Dadu - Moro	*	34	6	3	1	*		535	60	535	60	535	60	530	60	*		NA		–	–	–	–	–	–
N-1			–	–	–	–			–	–	–	–			–	–					–	–	–	–	–	–
Normal	220 kV Dadu - Khuzdar I	106	42	50	19	3	238	360	240	240	240	60	240	240	240	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Dadu - Khuzdar II	99	42	33	19	3	238	360	240	240	240	60	240	240	240	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Dadu - Matiari	**			1	NP	**						535	60	NP		**						–	–	NP	
N-1					–								–	–									–	–		

* Energized April, 2019 ** Added in 2020-21 NA: Not applicable NP: Not provided

*** 500 kV Dadu - Guddu II line bifurcated into Dadu - Shikarpur II & Guddu - Shikarpur II since March 2018 and does not exist anymore

Total No. of Variations (Normal)	265	152	113		10
Total No. of Variations (N-1)	–	–	–		–
Total of Normal & N-1	265	152	113		10

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

NTDC Hyderabad Region

2. 500kV Grid Station GUDDU

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Guddu - Dadu I	NP		–	NP		NP				–	–	NP				NP				–	–	NP			
N-1				–							–	–									–	–				
Normal	500 kV Guddu - Dadu II	521	*				540	420	*								–	–	*							
N-1		–					–	–									–	–								
Normal	500 kV Guddu - D.G. Khan (Old Multan)	504	10	48	33	41	540	300	535	300	538	420	538	360	540	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Guddu - 747 MW CCPP Guddu	NA		20	9	30	NA				538	360	538	180	539	120	NA				–	–	–	–	–	–
N-1				–	–	–					–	–			–	–					–	–	–	–	–	–
Normal	500 kV Guddu - Muzaffargarh	456	13	101	23	29	540	300	535	120	540	240	538	360	538	360	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Guddu - Shikarpur I	NA		29	20	18	NA				539	60	538	120	538	120	NA				–	–	–	–	–	–
N-1				–	–						–	–	–	–	–	–					–	–	–	–	–	–
Normal	500 kV Guddu - Shikarpur II	13	23	62	29	47	536	120	535	120	538	420	538	120	539	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Guddu - Sibbi (D/Ckt)	NP		–	NP		NP				–	–	NP				NP				–	–	NP			
N-1				–							–	–									–	–				
Normal	220 kV Guddu - Uch (P/H)	NP		–	NP		NP				–	–	NP				NP				–	–	NP			
N-1				–							–	–									–	–				

NA: Not applicable. NP: Not provided * 500 kV Dadu - Guddu II line bifurcated into Dadu - Shikarpur II & Guddu - Shikarpur II in March 2018 and does not exist anymore

Total No. of Variations (Normal)	1,494	46	260	114	165
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	1,494	46	260	114	165

Highest Voltage Under Normal Condition @500kV level

NTDC Hyderabad Region

3. 500kV Grid Station JAMSHORO

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Jamshoro - Dadu I	473	27	69	8	12	540	60	543	60	535	60	530	60	539	30	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Jamshoro - Dadu II	473	27	69	NP		540	60	543	60	535	60	NP				–	–	–	–	–	–	NP			
N-1		–	–	–			–	–	–	–	–	–					–	–	–	–	–	–				
Normal	500 KV Jamshoro-NKI	–	–	–	3	7	–	–	–	–	–		531	60	540	30	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–				–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Jamshoro - Hub (D/Ckt)	473	*	69	3	11	540	60	543	60	535	60	525	60	528	30	–	–	–	–	–	–	–	–	–	–
N-1		–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Jamshoro - Port Qasim	242	26	69	6	NP	540	60	543	60	535	60	534	60	NP		–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–		–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–	–	–
Normal	500 kV Jamshoro - Thar Engro	**	6	1	NP		**		535	60	528	30	NP				**		–	–	–	–	–	–	NP	
N-1			–	–					–	–	–	–							–	–	–	–	–	–		
Normal	500 kV Jamshoro - K2K3	Added in 2020-21			1	6	Added in 2020-21						529	60	530	60	Added in 2020-21								–	–
N-1					–	–							–	–	–	–									–	–
Normal	500 kV Jamshoro - CPHGC	Added in 2020-21			3	4							530	60	530	60	Added in 2020-21								–	–
N-1					–	–							–	–	–	–									–	–
Normal	220 kV Jamshoro - KDA33 - I	497	378	702	928	2049	244	60	241	60	244	60	242	60	242	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Jamshoro - KDA33 - II	497	378	702	928	2049	244	60	241	60	244	60	242	60	242	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Jamshoro - Hala Road I	497	409	747	1,134	5,093	244	60	241	60	244	60	244	60	250	30	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Jamshoro - Hala Road II	497	409	747	1,134		244	60	241	60	244	60	244	60	250	30	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Jamshoro - T.M. Khan - I	497	408	704	963	2,986	244	60	242	60	241	60	244	60	245	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Jamshoro - T.M. Khan - II	497	408	704	963	2,986	244	60	242	60	241	60	244	60	245	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Jamshoro - Jhimpir 2 - I	Added in 2021-22				493	Added in 2021-22								240	60	Added in 2020-21								–	–
N-1						–									–	–									–	–
Normal	220 kV Jamshoro - Jhimpir 2 - II	Added in 2021-22				493	Added in 2021-22								240	60	Added in 2020-21								–	–
N-1						–									–	–									–	–
Normal	500 kV Jamshoro - Matiari - I	Added in 2020-21			3	15	Added in 2020-21						528	60	540	30	Added in 2020-21						–	–	–	–
N-1					–	–							–	–	–	–							–	–	–	–
Normal	500 kV Jamshoro - Matiari - II	Added in 2020-21			9	16	Added in 2020-21						532	60	540	30	Added in 2020-21						–	–	–	–
N-1					–	–							–	–	–	–							–	–	–	–

NP: Not provided

* Only comparison reported

** Commissioned in Dec, 2018

Total No. of Variations (Normal)	4,874	5,755	3,879	6,086	16,220
Total No. of Variations (N-1)	–	–	–		–
Total of Normal & N-1	4,874	5,755	3,879	6,086	16,220

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

4. 500kV Grid Station NKI KARACHI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	**500 kV NKI - Hub**	139	6	1	NP		535	30	–	–	528	30	NP				–	–	472	30	–	–	NP			
N-1		–	–	–					–	–	–	–					–	–	–	–	–	–				
Normal	**500 kV NKI - Port Qasim**	138	6	–	NA	NP	535	30	–	–	–	–	NA		NP		–	–	472	30	–	–	NA		NP	
N-1		–	–	–			–	–	–	–	–	–					–	–	–	–	–	–				
Normal	**500 kV NKI - Jamshoro**	Added in 2020-21			NA		Added in 2020-21						NA				Added in 2020-21						NA			
N-1																										
Normal	**220 kV NKI - Baldia**	419	8	21	NA		241	120	240	30	234	150	NA				–	–	–	–	208	30	NA			
N-1		–	–	–			–	–	–	–	–	–					–	–	–	–	–	–				
Normal	**220 kV NKI - KDA33**	419	9	21	NA		241	120	240	30	234	150	NA				–	–	–	–	208	30	208	30	NA	
N-1		–	–	–			–	–	–	–	–	–					–	–	–	–	–	–	–	–		
Normal	**500 kV NKI - K2/K3**	Added in 2019		31	NA		Added in 2019				535	30	NA				Added in 2019				–	–	NA			
N-1				–							–	–									–	–				

* 500 kV NKI - Jamshoro line bifurcated into Jamshoro - Port Qasim & NKI - Port Qasim - NKI on 01-Nov-2017 and does not exist anymore

Total No. of Variations (Normal)	1,118	29	74	NA	NA
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	1,118	29	74	NA	NA

NTDC Hyderabad Region

5. 500kV Grid Station SHIKARPUR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	500 kV Shikarpur - Guddu Ckt I	1176	1120	970	827	1051	546	90	544	90	545	120	550	180	543	120	–	–	–	–	–	–	–	–	–	–
N-1		544	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Shikarpur - Guddu Ckt II	320	1177	973	828	1035	545	180	542	210	545	120	550	180	543	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Shikarpur - Dadu Ckt I	1193	82	965	832	1043	546	90	540	450	548	120	550	180	543	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	500 kV Shikarpur - Dadu Ckt II	318	1133	905	829	1034	545	180	541	270	548	120	550	180	543	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Shikarpur - Guddu Ckt I	482	548	869	1249	1486	240	180	240	150	242	120	245	180	242	150	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Shikarpur - Guddu Ckt II	50	660	1031	1099	1439	238	120	241	180	245	120	248	120	242	180	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Shikarpur - Uch Ckt I	480	506	831	1278	1529	240	180	240	150	242	120	245	180	242	150	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Shikarpur - Uch Ckt II	48	657	1029	1131	1595	238	120	241	180	241	240	248	120	242	150	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Shikarpur - Rohri I	37	687	1016	1107	1644	238	120	241	180	242	120	247	120	242	180	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Shikarpur - Rohri II	38	688	1013	1131	1638	238	120	241	180	242	330	248	120	242	180	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	4,142	7,258	9,602	10,311	13,494
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	4,142	7,258	9,602	10,311	13,494

Highest Voltage Under Normal Condition @500kV level

Highest Voltage Under Normal Condition @220kV level

NTDC Hyderabad Region

6. 220kV Grid Station DAHARKI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2020-21	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Dharki - Engro	NA		948	582	589	NA				250	120	251	60	247	60	–	–	NA				200	120	–	–
N-1				–	–	–					–	–	–	–	–	–	–	–					–	–	–	–
Normal	220 kV Ddharki - FPCDL	NA		964	583	589	NA				250	120	252	120	247	60	–	–	NA				200	120	–	–
N-1				–	–	–					–	–	–	–	–	–	–	–					–	–	–	–

Na: Not Applicable

Total No. of Variations (Normal)	NA	1912	1165	1178
Total No. of Variations (N-1)			–	–
Total of Normal & N-1		1912	1165	1178

Highest Voltage Under Normal Condition

NTDC Hyderabad Region

7. 220kV Grid Station HALA ROAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2016-17	2017-18	2018-19	2019-20	2020-21	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Hala Road - Jamshoro I	28	10	5	1	NA	240	60	240	30	238	270	240	30	NA		–	–	–	–	–	–	–	–	NA	
N-1		–	–	–	–		–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–		
Normal	220 kV Hala Road - Jamshoro II	28	10	5	1	NA	240	60	240	30	238	270	240	30	NA		–	–	–	–	–	–	–	–	NA	
N-1		–	–	–	–		–	–	–	–	–	–	–	–			–	–	–	–	–	–	–	–		

Total No. of Variations (Normal)	56	20	10	2	NA	
Total No. of Variations (N-1)	–	–	–	–		
Total of Normal & N-1	56	20	10	2		

NTDC Hyderabad Region

8. 220kV Grid Station KHUZDAR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Dadu - Khuzdar I	141	123	983	1386	1760	248	30	250	35	248	60	250	60	245	60	190	35	180	30	180	60	–	–	178	60
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Dadu - Khuzdar II	141	123	983	1386	1760	248	30	250	35	248	60	250	60	245	60	190	35	180	30	180	60	–	–	178	60
N-1		–	–	–	–	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	282	246	1,966	2,772	3,520
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	282	246	1,966	2,772	3,520

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Hyderabad Region

9. 220kV Grid Station LORALAI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2020-21	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Loralai - D.G. Khan I	1570	991	1094	965	1569	254	300	242	240	250	120	245	60	256	120	180	180	143	180	195	60	–	–	198	60
N-1		–	154	126	67	64	–	–	255	60	255	60	250	60	255	60	–	–	190	60	190	180	–	–	190	120
Normal	220 kV Loralai - D.G. Khan II	1570	991	1094	965	1569	254	300	242	240	250	120	245	60	256	120	180	180	143	180	195	60	–	–	198	60
N-1		–	154	126	67	64	–	–	255	60	255	60	250	60	255	60	–	–	190	60	190	180	–	–	190	120

Total No. of Variations (Normal)	3,140	1,982	2,188	1,930	3,138
Total No. of Variations (N-1)	–	308	252	134	128
Total of Normal & N-1	3,140	2,290	2,440	2,064	3,266

Highest Voltage Under Normal Condition

Highest Voltage Under N-1 Condition

Lowest Voltage Under Normal Condition

Lowest Voltage Under N-1 Normal Condition

NTDC Hyderabad Region

10. 220kV Grid Station QUETTA INDUSTRIAL-II

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Sibbi - Quetta Ckt I	3022	4379	5468	2851	6196	–	–	280	60	–	–	239	60	242	60	180	60	178	60	176	60	180	60	170	60
N-1		–	–	–	2424	2277	–	–	–	–	–	–	245	60	–	–	–	–	–	–	–	–	170	60	168	60
Normal	220 kV Sibbi - Quetta Ckt II	3022	4379	5468	2851	5815	–	–	280	60	–	–	239	60	242	60	180	60	178	60	176	60	180	60	170	60
N-1		–	–	–	2424	746	–	–	–	–	–	–	245	60	–	–	–	–	–	–	–	–	170	60	168	60

Total No. of Variations (Normal)	6,044	8,758	10,936	5,702	12,011
Total No. of Variations (N-1)	–	–	–	–	3,023
Total of Normal & N-1	6,044	8,758	10,936	5,702	15,034

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

Lowest Voltage Under N-1 Condition

NTDC Hyderabad Region

11. 220kV Grid Station ROHRI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Shikarpur - Rohri I	20	83	460	544	1276	236	60	232	60	246	60	247	60	244	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Shikarpur - Rohri II	20	83	460	544	1276	236	60	232	60	246	60	247	60	244	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Rohri - Engro I	15	17	24	206	1276	238	180	232	60	244	60	247	120	244	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Rohri - Engro II	15	17	24	206	1276	238	180	232	60	244	60	247	120	244	120	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	70	200	968	1,500	5,104
Total No. of Variations (N-1)	–	–	–		
Total of Normal & N-1	70	200	968	1,500	5,104

Highest Voltage Under Normal Condition

NTDC Hyderabad Region

12. 220kV Grid Station SIBBI

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Sibbi - Quetta Ckt I	534	410	777	700	811	238	60	246	60	241	60	243	60	244	60	196	60	207	60	205	60	–	–	200	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Sibbi - Quetta Ckt II	534	410	777	700	811	238	60	246	60	241	60	243	60	244	60	196	60	207	60	205	60	–	–	200	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Sibbi - Uch Ckt I	289	943	1554	1160	1557	240	60	246	60	250	60	245	60	246	60	200	120	–	–	207	60	–	–	200	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Sibbi - Uch Ckt II	289	943	1554	1160	1557	240	60	246	60	250	60	245	60	246	60	200	120	–	–	207	60	–	–	200	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Sibbi - Guddu DC Ckt	258	931	1514	1160	1557	240	60	246	60	250	60	245	60	246	60	200	60	–	–	207	60	–	–	200	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Sibbi - Uch DC Ckt	258	971	1505	1160	1557	240	60	246	60	250	60	245	60	246	60	200	120	–	–	206	60	–	–	200	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	220 kV Sibbi - D. M Jamali Ckt	77	902	1505	1160	1557	240	60	246	60	250	60	245	60	246	60	–	–	–	–	207	60	–	–	200	120
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

* Energized on 05-05-2018

Total No. of Variations (Normal)	2,239	4,579	9,186	7,200	9,407
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	2,239	4,579	9,186	7,200	9,407

Highest Voltage Under Normal Condition

Lowest Voltage Under Normal Condition

NTDC Hyderabad Region

13. 220kV Grid Station T.M. KHAN ROAD

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Highest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV T.M.Khan - Jamshoro I	287	671	1284	456	593	242	60	247	60	243	60	245	60	242	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV T.M.Khan - Jamshoro II	287	671	1284	456	593	242	60	247	60	243	60	245	60	242	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV T.M.Khan - Jhimpir I	240	738	1320	456	593	242	60	247	60	243	60	245	60	242	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV T.M.Khan - Jhimpir II	240	738	1320	456	593	242	60	247	60	243	60	245	60	242	60	–	–	–	–	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	1,054	2,818	5,208	1,824	2,372
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	1,054	2,818	5,208	1,824	2,372

Highest Voltage Under Normal Condition

NTDC Hyderabad Region

14. 220kV Grid Station JHIMPIR

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2017-18		2018-19		2019-20		2020-21		2021-22		2017-18		2018-19		2019-20		2020-21		2021-22	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV Jhimpir - T.M.Khan I	174	444	415	101	205	245	60	247	60	245	120	249	60	246	60	–	–	190	60	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Normal	220 kV Jhimpir - T.M.Khan II	174	444	415	101	205	245	60	247	60	245	120	249	60	246	60	–	–	190	60	–	–	–	–	–	–
N-1		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Total No. of Variations (Normal)	348	888	830	202	410
Total No. of Variations (N-1)	–	–	–	–	–
Total of Normal & N-1	348	888	830	202	410

Highest Voltage Under Normal Condition

NTDC Hyderabad Region

15. 220kV Grid Station Dera Murad Jamali

Condition	Name of Transmission Circuit(s) violating the voltage criteria	Total Number / Times violating the limit					Highest Voltage Recorded (kV) / Time (Min)										Lowest Voltage Recorded (kV) / Time (Min)									
		2017-18	2018-19	2019-20	2020-21	2021-22	2016-17		2017-18		2018-19		2019-20		2020-21		2016-17		2017-18		2018-19		2019-20		2020-21	
							Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time	Voltage	Time
Normal	220 kV D. M. Jamali - Uch	*	1119	2205	NP	1671	*		241	60	241	120	NP		241	60	*		–	–	–	–	NP		–	–
N-1			–	–		–			–	–	–	–			–	–			–	–	–	–			–	–
Normal	220 kV D. M. Jamali - Sibbi	*	**	2625	NP	1604	*		241	60	241	120	NP		241	60	*		–	–	–	–	NP		–	–
N-1				–		–			–	–	–	–			–	–			–	–	–	–			–	–

* Added in 2018-19

* *Only comparison reported

Total No. of Variations (Normal)		1,119	4,830	NP	3,275
Total No. of Variations (N-1)		–	–		–
Total of Normal & N-1		1,119	4,830		3,275

Highest Voltage Under Normal Condition

APPENDIX 5

Monthly Loading Position of Power Transformers

S. No.	Name of Grid Station	Auto/Power Transformer	Voltage Level (kV)	Cap. (MVA)	Cap. (A)	July (A)	July (%)	Aug (A)	Aug (%)	Sep (A)	Sep (%)	Oct (A)	Oct (%)	Nov (A)	Nov (%)	Dec (A)	Dec (%)	Jan (A)	Jan (%)	Feb (A)	Feb (%)	Mar (A)	Mar (%)	Apr (A)	Apr (%)	May (A)	May (%)	June (A)	June (%)
1	500 kV Jamshoro	T-1	500/220	450	1125	990	**88**	960	**85**	1000	**89**	1035	**92**	930	**83**	515	46	670	60	670	60	885	79	975	87	1030	92	915	81
	500 kV Jamshoro	T-2	500/220	450	1125	990	**88**	960	**85**	1000	**89**	1035	**92**	930	**83**	515	46	670	60	670	60	990	88	975	87	1030	92	915	81
	500 kV Jamshoro	T-3	220/132	160	700	515	74	630	**90**	585	**84**	565	**81**	400	57	385	55	435	62	375	54	605	86	590	84	515	74	605	86
	500 kV Jamshoro	T-7	220/132	160	700	515	74	630	**90**	585	**84**	565	**81**	400	57	385	55	435	62	375	54	605	86	590	84	515	74	605	86
	500 kV Jamshoro	T-8	500/220	450	1125	990	**88**	960	**85**	1000	**89**	1035	**92**	930	**83**	515	46	670	60	670	60	990	88	975	87	910	81	915	81
2	500 kV Dadu	T-2	500/220	450	1125	1010	**90**	775	69	705	63	845	75	565	50	470	42	470	42	710	63	580	52	805	72	1010	90	775	69
	500 kV Dadu	T-4	500/220	450	1125	815	72	790	70	735	65	740	66	595	53	500	44	500	44	870	77	1065	95	820	73	775	69	790	70
	500 kV Dadu	T-1	220/132	160	700	520	74	480	69	550	79	450	64	350	50	200	29	475	68	200	29	525	75	670	96	600	86	600	86
	500 kV Dadu	T-3	220/132	160	700	620	**89**	530	76	550	79	430	61	300	43	250	36	425	61	225	32	250	36	550	79	530	76	500	71
	500 kV Dadu	T-5	220/132	250	1094	930	**85**	845	77	825	75	670	61	450	41	430	39	450	41	350	32	400	37	850	78	850	78	725	66
3	500 kV NKI Karachi	T-1	500/220	600	1594	1260	79	1295	**81**	1285	**81**	1265	79	1265	79	1155	72	1170	73	1200	75	1220	77	1220	77	1260	79	1240	78
	500 kV NKI Karachi	T-2	500/220	600	1594	1260	79	1295	**81**	1285	**81**	1265	79	1265	79	1155	72	1170	73	1200	75	1220	77	1220	77	1260	79	1240	78
4	500 kV Guddu	T-1	500/220	450	1125	273	24	273	24	341	30	318	28	568	50	568	50	364	32	455	40	455	40	545	48	455	40	636	57
	500 kV Guddu	T-2	500/220	450	1125	273	24	273	24	341	30	318	28	568	50	568	50	364	32	455	40	455	40	545	48	455	40	568	50
	500 kV Guddu	T-3	500/220	450	1125	273	24	273	24	341	30	318	28	568	50	568	50	364	32	455	40	455	40	545	48	455	40	568	50
5	220 kV Hala Road	T-1	220/132	160	700	540	77	520	74	661	**94**	559	80	370	53	300	43	330	47	330	47	52	7	599	86	599	86	651	93
	220 kV Hala Road	T-2	220/132	160	700	540	77	520	74	589	**84**	460	66	370	53	300	43	330	47	510	73	540	77	599	86	599	86	651	93
	220 kV Hala Road	T-3	220/132	250	1093.5	916	**84**	790	72	910	**83**	900	**82**	810	74	380	35	435	40	430	39	676	62	872	80	701	64	840	77
	220 kV Hala Road	T-4	132/11	20/26	1305	1000	77	984	75	1044	**80**	984	75	780	60	624	48	600	46	636	49	876	67	1032	79	1056	81	1056	81
	220 kV Hala Road	T-5	132/11	20/26	1305	1040	80	1008	77	1116	**86**	1020	78	780	60	576	44	672	51	708	54	960	74	1176	90	1150	88	1080	83
	220 kV Hala Road	T-6	132/66	37.5/40	2000	Opened																							
6	220 kV T. M. Khan	T-1	220/132	160	700	626	**89**	535	76	600	**86**	605	**86**	395	56	355	51	340	49	310	44	460	66	550	79	500	71	560	80
	220 kV T. M. Khan	T-2	220/132	160	700	628	**90**	535	76	600	**86**	605	**86**	395	56	355	51	340	49	310	44	460	66	550	79	500	71	560	80
	220 kV T. M. Khan	T-3	132/11	10/13	652	560	**86**	560	**86**	520	**80**	560	**86**	480	74	396	61	360	55	440	67	500	77	520	80	540	83	540	83
	220 kV T. M. Khan	T-4	132/11	10/13	652	600	**92**	560	**86**	600	**92**	540	**83**	400	61	384	59	300	46	400	61	560	86	600	92	600	92	600	92
7	220 kV Jhimpir	T-1	220/132	250	1093	837	77	852	78	1019	**93**	901	**82**	900	**82**	830	76	916	84	**980**	90	968	89	986	90	830	76	880	81
	220 kV Jhimpir	T-2	220/132	250	1093	837	77	852	78	1019	**93**	901	**82**	900	**82**	830	76	916	84	**980**	90	968	89	986	90	830	76	880	81
	220 kV Jhimpir	T-3`	220/132	250	1093	837	77	852	78	1019	**93**	901	**82**	900	**82**	830	76	916	84	**980**	90	968	89	986	90	830	76	880	81
	220 kV Jhimpir	T-4	220/132	250	1093	Not Existing																		780	71	830	76	880	81
8	220 kV Jhimpir-II	T-1	250	250	1200	Not Existing																		-	-	1090	91	720	60
	220 kV Jhimpir-II	T-2	220/132	250	1200																			850	71	1090	91	810	68
	220 kV Jhimpir-II	T-3`	220/132	250	1200																			850	71	740	62	810	68
9	500 kV Shikarpur	T-6	500/220	600	1574	730	46	720	46	850	54	820	52	1010	64	940	60	880	56	**750**	48	630	40	810	51	680	43	790	50
	500 kV Shikarpur	T-7	500/220	600	1574	730	46	720	46	850	54	820	52	1010	64	940	60	880	56	750	48	630	40	810	51	680	43	790	50
	500 kV Shikarpur	T-1	220/132	160	700	570	**81**	720	**103**	630	**90**	430	61	310	44	400	57	**570**	81	250	36	420	60	580	83	580	83	560	80
	500 kV Shikarpur	T-2	220/132	250	1100	1000	**91**	1020	**93**	1020	**93**	890	**81**	570	52	520	47	630	57	540	49	850	77	1000	91	930	85	960	87
	500 kV Shikarpur	T-3	220/132	160	700	570	**81**	620	**89**	660	**94**	430	61	380	54	300	43	230	33	250	36	400	57	580	83	580	83	560	80
	500 kV Shikarpur	T-4	132/11	10/13	652	130	20	130	20	140	21	No Load				110	17	No Load											
	500 kV Shikarpur	T-5	132/11	10/13	652	100	15	No Load		120	18	180	28	100	15	120	18	110	17	110	17	140	21	130	20	130	20	130	20
10	220 kV Daharki	T-1	220/132	250	1093.5	620	57	700	64	400	37	400	37	200	18	330	30	400	37	300	27	400	37	670	61	400	37	620	57
	220 kV Daharki	T-2	220/132	160	700	360	51	460	66	250	36	250	36	150	21	200	29	520	74	350	50	220	31	384	55	80	11	370	53
11	220 kV Rohri	T-1	220/132	250	1093.5	860	79	830	76	650	59	570	52	260	24	360	33	600	55	590	54	500	46	780	71	580	53	680	62
	220 kV Rohri	T-2	220/132	250	1093.5	860	79	830	76	650	59	480	44	240	22	360	33	600	55	530	48	670	61	780	71	580	53	680	62
	220 kV Rohri	T-3	132/11	10/13	652	20	3	20	3	20	3	20	3	20	3	20	3	20	3	20	3	20	3	20	3	20	3	20	3
12	220 kV NTDC Switcyard Guddu	T-13	220/132	160	700	Not Existing																280	40	290	41	295	42	300	43

Above 80% 70% to 80% Below 70%

S. No.	Name of Grid Station	Auto/Power Transformer	Voltage Level (kV)	Cap.	Cap.	July	July	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	June	June
				(MVA)	(A)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)
13	220 kV Sibbi	T-1	220/132	160	700	485	69	462	66	497	71	440	63	415	59	443	63	549	78	444	63	471	67	477	68	507	72	570	81
	220 kV Sibbi	T-2	220/132	160	700	485	69	462	66	497	71	440	63	415	59	443	63	549	78	444	63	515	74	477	68	507	72	567	81
	220 kV Sibbi	T-3	132/11	20/26	1305	1260	97	1250	96	1260	97	1210	93	1090	84	1230	94	1150	88	900	69	825	63	900	69	995	76	965	74
	220 kV Sibbi	T-4	132/11	20/26	1305	1220	93	1260	97	1230	94	1080	83	750	57	1030	79	970	74	860	66	1020	78	1280	98	1270	97	1240	95
14	220 kV Quetta Ind-II	T-1	220/132	160	700	580	83	600	86	580	83	530	76	510	73	500	71	550	79	570	81	580	83	550	79	600	86	580	83
	220 kV Quetta Ind-II	T-2	220/132	160	700	580	83	600	86	580	83	530	76	510	73	500	71	550	79	570	81	580	83	550	79	600	86	700	100
	220 kV Quetta Ind-II	T-3	220/132	250	1095	960	88	980	89	950	87	940	86	940	86	980	89	970	89	980	89	820	75	990	90	970	89	940	86
	220 kV Quetta Ind-II	T-4	132/11	31.5/40	2008.2	1340	67	1640	82	1260	63	1240	62	1260	63	1060	53	1200	60	1220	61	1170	58	1210	60	1260	63	1290	64
	220 kV Quetta Ind-II	T-5	132/11	31.5/40	2008.2	1830	91	1720	86	1670	83	1490	74	1310	65	1360	68	1250	62	1190	59	1020	51	1240	62	1180	59	1280	64
	220 kV Quetta Ind-II	T-6	132/11	31.5/40	2008.2	1660	83	1630	81	1510	75	1380	69	1040	52	1130	56	1180	59	1330	66	1270	63	1580	79	1520	76	1490	74
15	220 kV Khuzdar	T-1	220/132	160	700	530	76	520	74	490	70	480	69	500	71	500	71	530	76	500	71	550	79	540	77	560	80	560	80
	220 kV Khuzdar	T-2	220/132	160	700	530	76	520	74	490	70	480	69	500	71	500	71	530	76	500	71	550	79	540	77	620	89	560	80
16	220 kV Loralai	T-1	220/132	250	1093.5	590	54	660	60	690	63	880	80	920	84	800	73	900	82	860	79	920	84	560	51	570	52	540	49
	220 kV Loralai	T-2	220/132	250	1093.5	590	54	660	60	690	63	560	51	530	48	450	41	800	73	480	44	580	53	560	51	570	52	540	49
17	220 kV D.M.Jamali	T-1	220/132	160	700	175	25	190	27	180	26	125	18	105	15	140	20	215	31	115	16	140	20	180	26	180	26	170	24
	220 kV D.M.Jamali	T-2	220/132	160	700	175	25	190	27	180	26	150	21	110	16	140	20	120	17	115	16	140	20	180	26	180	26	170	24
18	500 kV Peshawar	T-1	500/220	450	1180	1020	86	1070	91	1080	92	840	71	590	50	880	75	790	67	480	41	550	47	760	64	650	55	680	58
	500 kV Peshawar	T-2	500/220	450	1180	1020	86	1070	91	1080	92	840	71	590	50	880	75	790	67	480	41	550	47	760	64	650	55	680	58
	500 kV Peshawar	T-3	500/220	450	1180	1020	86	1070	91	1080	92	840	71	590	50	880	75	790	67	480	41	550	47	760	64	650	55	680	58
	500 kV Peshawar	T-5	220/132	250	1093	920	84	860	79	910	83	780	71	660	60	900	82	600	55	700	64	640	59	770	70	790	72	860	79
	500 kV Peshawar	T-6	220/132	250	1093	920	84	860	79	910	83	780	71	660	60	900	82	600	55	700	64	640	59	770	70	790	72	860	79
	500 kV Peshawar	T-7	220/132	250	1093	920	84	860	79	910	83	780	71	660	60	900	82	600	55	700	64	640	59	770	70	790	72	860	79
	500 kV Peshawar	T-8	220/132	250	1093	920	84	860	79	910	83	780	71	660	60	900	82	600	55	700	64	640	59	770	70	790	72	820	75
	500 kV Peshawar	T-10	132/11.5	20/26	1305	1110	85	1260	97	1080	83	750	57	760	58	1130	87	870	67	990	76	810	62	1260	97	1120	86	1070	82
	500 kV Peshawar	T-11	132/11.5	10/13	653	402	62	402	62	402	62	402	62	422	65	402	62	402	62	402	62	402	62	402	62	422	65	402	62
19	500 kV Rawat	T-1	500/220	450	1125	1060	94	1010	90	900	80	720	64	630	56	620	55	860	76	760	68	550	49	900	80	850	76	900	80
	500 kV Rawat	T-2	500/220	450	1125	1060	94	1010	90	900	80	720	64	630	56	700	62	860	76	760	68	550	49	900	80	850	76	900	80
	500 kV Rawat	T-3	500/220	450	1125	1060	94	1010	90	900	80	720	64	630	56	700	62	860	76	760	68	550	49	900	80	850	76	900	80
	500 kV Rawat	T-4	500/220	750	1875	1810	97	1750	93	1620	86	1280	68	1000	53	1240	66	1530	82	1040	55	940	50	1180	63	1440	77	1520	81
	500 kV Rawat	T-5	220/132	250	1093	1030	94	990	91	970	89	730	67	780	71	900	82	600	55	700	64	590	54	770	70	920	84	980	90
	500 kV Rawat	T-6	220/132	250	1093	1030	94	990	91	970	89	730	67	780	71	900	82	600	55	700	64	590	54	770	70	920	84	980	90
	500 kV Rawat	T-7	220/132	250	1093	1030	94	990	91	970	89	730	67	740	68	740	68	600	55	700	64	590	54	770	70	920	84	980	90
	500 kV Rawat	T-8	220/132	160	700	660	94	640	91	640	91	460	66	490	70	PTW		550	79	700	100	590	84	770	110	920	131	980	140
	500 kV Rawat	T-9	132/11.5	20/26	1305	440	34	700	54	380	29	340	26	320	25	380	29	490	38	370	28	370	28	480	37	480	37	520	40
	500 kV Rawat	T-10	132/11.5	20/26	1305	480	37	500	38	470	36	500	38	370	28	370	28	630	48	390	30	390	30	500	38	450	34	490	38
20	500 kV Sheikhupura	TB-01	500/220	600	1575	1550	98	1520	97	1380	88	1250	79	1000	63	1050	67	1045	66	1110	70	1150	73	1330	84	1410	90	1450	92
	500 kV Sheikhupura	TB-02	500/220	600	1575	1550	98	1520	97	1380	88	1250	79	1000	63	1050	67	1045	66	1110	70	1150	73	1330	84	1410	90	1450	92
	500 kV Sheikhupura	TB-03	500/220	600	1575	1550	98	1520	97	1380	88	1250	79	1000	63	1050	67	1045	66	1110	70	1150	73	1330	84	1410	90	1450	92
	500 kV Sheikhupura	TB-04	500/220	600	1575	1550	98	1520	97	1380	88	1250	79	1000	63	1050	67	1045	66	1110	70	1150	73	1330	84	1410	90	1450	92
	500 kV Sheikhupura	T-5	220/132	160	700	595	85	575	82	580	83	580	83	580	83	550	79	585	84	565	81	555	79	545	78	565	81	585	84
	500 kV Sheikhupura	T-6	220/132	160	700	625	89	520	74	660	94	620	89	625	89	630	90	620	89	620	89	610	87	610	87	625	89	615	88
	500 kV Sheikhupura	T-7	220/132	160	700	740	106	670	96	680	97	665	95	670	96	645	92	675	96	670	96	665	95	670	96	685	98	675	96
	500 kV Sheikhupura	T-8	220/132	160	700	705	101	630	90	680	97	670	96	670	96	675	96	685	98	620	89	655	94	655	94	680	97	695	99

Above 80% 70% to 80% Below 70%

S. No.	Name of Grid Station	Auto/Power Transformer	Voltage Level (kV)	Cap.	Cap.	July	July	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	June	June
				(MVA)	(A)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)
21	500 kV Gatti	T-1	500/220	450	1181	1100	93	1086	92	1080	91	972	82	729	62	620	52	568	48	536	45	1051	89	1045	88	1045	88	1050	89
	500 kV Gatti	T-2	500/220	450	1181	1104	93	1095	93	1100	93	980	83	739	63	630	53	568	48	543	46	1061	90	1056	89	1053	89	1060	90
	500 kV Gatti	T-3	500/220	450	1181	1077	91	1063	90	1075	91	951	81	709	60	610	52	558	47	519	44	1032	87	1025	87	1024	87	1033	87
	500 kV Gatti	T-4	500/220	450	1181	1077	91	1063	90	1075	91	951	81	709	60	610	52	558	47	519	44	1032	87	1025	87	1024	87	1030	87
	500 kV Gatti	T-5	500/220	600	1575	1480	94	1600	102	1290	82	1100	70	1180	75	1300	83	1220	77	1120	71	Dismantling		Not Existing					
22	500 kV Faisalabad West	ATB-2	500/220	750	1968	Not Existing														367	19	426	22	645	33	470	24	500	25
	500 kV Faisalabad West	ATR-4	220/132	250	1095	July 2021 to Mar 2022 ATR-4; Apr 2022 to June 2022 ATR-8														766	70	847	77	990	90	1055	96	870	79
	500 kV Faisalabad West	ATB-3	220/132	750	1968	Not Existing																		885	45	980	50	1040	53
	500 kV Faisalabad West	ATR-9	220/132	250	1095																			575	53	790	72	840	77
23	500 kV Nokhar	T-1	500/220	600	1575	1560	99	1560	99	1350	86	1300	83	1400	89	1070	68	1150	73	1080	69	1450	92	1360	86	1400	89	1460	93
	500 kV Nokhar	T-2	500/220	600	1575	1560	99	1560	99	1350	86	1300	83	1400	89	1070	68	1150	73	1080	69	1450	92	1360	86	1400	89	1460	93
	500 kV Nokhar	T-3	500/220	600	1575	Not Existing																						910	58
	500 kV Nokhar	T-4	220/132	160	700	680	97	660	94	630	90	630	90	610	87	600	86	610	87	610	87	650	93	660	94	620	89	650	93
	500 kV Nokhar	T-5	220/132	160	700	680	97	660	94	630	90	630	90	610	87	600	86	610	87	610	87	650	93	660	94	620	89	650	93
	500 kV Nokhar	T-6	220/132	160	700	680	97	660	94	630	90	630	90	610	87	600	86	610	87	610	87	650	93	660	94	620	89	650	93
24	500 kV Yousafwala	T-1	500/220	600	1575	1400	89	1420	90	1300	83	1120	71	795	50	940	60	895	57	900	57	1140	72	1340	85	1350	86	1130	72
	500 kV Yousafwala	T-2	500/220	600	1575	1400	89	1420	90	1300	83	1120	71	795	50	940	60	895	57	900	57	1140	72	1340	85	1350	86	1130	72
	500 kV Yousafwala	T-9	500/220	600	1575	1400	89	1420	90	1300	83	1120	71	795	50	940	60	895	57	900	57	1140	72	1340	85	1350	86	1130	72
	500 kV Yousafwala	T-3	220/132	160	700	686	98	676	97	665	95	680	97	490	70	545	78	455	65	580	83	587	84	650	93	632	90	505	72
	500 kV Yousafwala	T-4	220/132	160	700	686	98	676	97	665	95	680	97	490	70	545	78	455	65	580	83	587	84	650	93	632	90	505	72
	500 kV Yousafwala	T-5	220/132	160	700	686	98	676	97	665	95	680	97	490	70	545	78	455	65	580	83	587	84	650	93	632	90	505	72
	500 kV Yousafwala	T-6	220/132	160	700	686	98	676	97	665	95	680	97	490	70	545	78	455	65	580	83	587	84	650	93	632	90	505	72
	500 kV Yousafwala	T-7	132/11.5	20/26	1305	680	52	635	49	665	51	695	53	395	30	396	30	345	26	385	30	535	41	665	51	685	52	715	55
	500 kV Yousafwala	T-8	132/11.5	20/26	1305	1020	78	1020	78	920	70	830	64	580	44	590	45	620	48	580	44	850	65	1070	82	1010	77	1100	84
25	500 kV New Lahore	T-1	500/220	750	1968	1535	78	1550	79	1395	71	1265	64	1120	57	1190	60	990	50	1110	56	1170	59	1285	65	1390	71	1450	74
	500 kV New Lahore	T-2	500/220	750	1968	1535	78	1550	79	1395	71	1265	64	1030	52	1190	60	990	50	1110	56	1170	59	1285	65	1390	71	1450	74
	500 kV New Lahore	T-3	500/220	750	1968	1535	78	1550	79	1395	71	1265	64	1120	57	1190	60	990	50	1080	55	1170	59	1285	65	1390	71	1450	74
26	500 kV Multan	TR-1	525/231/22	450	1125	1112	99	1114	99	1138	101	877	78	866	77	844	75	755	67	777	69	953	85	1044	93	1019	91	1021	91
	500 kV Multan	TR-2	525/231/22	450	1125	1112	99	1114	99	1138	101	877	78	866	77	844	75	755	67	777	69	953	85	1044	93	1019	91	1021	91
	500 kV Multan	TR-3	220/132	160	700	672	96	643	92	625	89	601	86	525	75	497	71	403	58	409	58	601	86	651	93	656	94	673	96
	500 kV Multan	TR-4	220/132	160	700	672	96	643	92	625	89	601	86	525	75	497	71	403	58	445	64	601	86	651	93	656	94	673	96
	500 kV Multan	TR-5	220/132	160	700	672	96	643	92	625	89	601	86	525	75	497	71	403	58	445	64	601	86	651	93	656	94	673	96
	500 kV Multan	TR-6	132/11	6.3	316	19	6	20	6	22	7	20	6	12	4	9	3	9	3	10	3	18	6	20	6	18	6	22	7
27	500 kV Muzaffargarh	ATB-1	525/231/23	600	1500	1400	93	1400	93	1340	89	1190	79	1100	73	1070	71	1160	77	980	65	1070	71	1340	89	1330	89	1180	79
	500 kV Muzaffargarh	ATB-2	525/231/23	600	1500	1360	91	1365	91	1440	96	1090	73	1100	73	1100	73	890	59	960	64	1050	70	1280	85	1360	91	1150	77
28	500 kV D. G. Khan	TR-1	525/231/23	600	1499	603	40	617	41	603	40	506	34	527	35	460	31	578	39	503	34	487	32	538	36	543	36	539	36
	500 kV D. G. Khan	TR-2	525/231/23	600	1499	603	40	617	41	603	40	506	34	527	35	460	31	578	39	503	34	487	32	538	36	543	36	539	36
	500 kV D. G. Khan	TR-3	220/132	250	1093	538	49	539	49	475	43	585	54	353	32	344	31	427	39	637	58	430	39	531	49	533	49	547	50
	500 kV D. G. Khan	TR-4	220/132	250	1093	538	49	539	49	475	43	585	54	353	32	344	31	427	39	720	66	430	39	531	49	533	49	547	50
29	500 kV Rahim Yar Khan	ATB-2	500/220	600	1499.6	650	43	608	41	565	38	470	31	214	14	234	16	147	10	210	14	283	19	463	31	569	38	580	39
	500 kV Rahim Yar Khan	ATB-3	500/200	600	1499.6	650	43	676	45	565	38	682	45	214	14	234	16	147	10	210	14	283	19	463	31	569	38	580	39
	500 kV Rahim Yar Khan	T-5	220/132	250	1093.5	1033	94	981	90	910	83	629	58	534	49	802	73	410	37	715	65	481	44	781	71	967	88	921	84
	500 kV Rahim Yar Khan	T-6	220/132	250	1093.5	1033	94	981	90	910	83	629	58	450	41	282	26	300	27	620	57	792	72	781	71	967	88	921	84

Above 80% 70% to 80% Below 70%

S. No.	Name of Grid Station	Auto/Power Transformer	Voltage Level (kV)	Cap.	Cap.	July	July	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	June	June
				(MVA)	(A)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)
30	220 kV Nishatabad	T-1	220/132	160	700	545	78	510	73	460	66	420	60	470	67	460	66	420	60	410	59	400	57	475	68	515	74	500	71
	220 kV Nishatabad	T-2	220/132	160	700	590	84	550	79	490	70	435	62	455	65	445	64	405	58	400	57	435	62	540	77	565	81	540	77
	220 kV Nishatabad	T-3	220/132	160	700	655	94	625	89	605	86	550	79	615	88	600	86	545	78	510	73	540	77	570	81	655	94	650	93
	220 kV Nishatabad	T-4	220/132	160	700	545	78	510	73	460	66	420	60	470	67	460	66	420	60	410	59	400	57	475	68	515	74	500	71
	220 kV Nishatabad	T-5	220/132	160	700	545	78	510	73	460	66	420	60	470	67	460	66	420	60	410	59	400	57	475	68	515	74	500	71
	220 kV Nishatabad	T-6	132/66	30/37.5	328	90	27	88	27	82	25	70	21	46	14	54	16	60	18	52	16	62	19	78	24	90	27	96	29
	220 kV Nishatabad	T-7	132/66	30/37.5	328	90	27	88	27	82	25	70	21	46	14	54	16	60	18	52	16	62	19	78	24	90	27	96	29
31	220 kV Jaranwala Road	T-1	220/132	160	700	637	91	616	88	607	87	608	87	448	64	395	56	435	62	318	45	527	75	572	82	496	71	521	74
	220 kV Jaranwala Road	T-2	220/132	160	700	632	90	613	88	606	87	606	87	448	64	398	57	443	63	322	46	523	75	570	81	497	71	517	74
	220 kV Jaranwala Road	T-3	220/132	160	700	614	88	598	85	588	84	583	83	429	61	383	55	323	46	306	44	505	72	562	80	482	69	505	72
	220 kV Jaranwala Road	T-4	220/132	160	700	672	96	653	93	643	92	625	89	464	66	389	56	392	56	301	43	543	78	595	85	515	74	543	78
	220 kV Jaranwala Road	T-5	132/11.5	40	2008	1630	81	1610	80	1360	68	1280	64	962	48	1350	67	875	44	760	38	1080	54	1190	59	1210	60	1470	73
	220 kV Jaranwala Road	T-6	132/11.5	20/26	1305	1150	88	1190	91	990	76	885	68	660	51	510	39	1125	86	570	44	920	70	1030	79	1070	82	1180	90
32	220 kV Samundri Road	T-1	220/132	250	1093	1035	95	770	70	505	46	585	54	705	65	850	78	750	69	920	84	810	74	665	61	760	70	560	51
	220 kV Samundri Road	T-2	220/132	160	700	545	78	635	91	435	62	560	80	425	61	585	84	480	69	575	82	640	91	505	72	385	55	185	26
	220 kV Samundri Road	T-3	220/132	160	700	645	92	710	101	510	73	600	86	405	58	635	91	410	59	460	66	640	91	600	86	450	64	185	26
	220 kV Samundri Road	T-4	132/11	20/26	1305	775	59	755	58	620	48	580	44	365	28	235	18	300	23	300	23	545	42	685	52	715	55	850	65
	220 kV Samundri Road	T-5	132/11.5	10/13	653	510	78	475	73	420	64	380	58	275	42	215	33	265	41	225	34	490	75	475	73	485	74	540	83
33	220 kV Ludewala	T-1	220/132	160	700	700	100	695	99	675	96	535	76	635	91	625	89	575	82	610	87	655	94	660	94	670	96	660	94
	220 kV Ludewala	T-2	220/132	250	1093	1080	99	1090	100	1090	100	1015	93	730	67	810	74	590	54	665	61	950	87	1040	95	1080	99	1075	98
	220 kV Ludewala	T-3	220/132	250	1093	1080	99	1090	100	1090	100	1015	93	730	67	810	74	590	54	665	61	950	87	1040	95	1080	99	1075	98
	220 kV Ludewala	T-4	132/11.5	10/13	653	492	75	447	68	412	63	382	58	182	28	242	37	182	28	177	27	342	52	462	71	462	71	532	81
34	220 kV Bandala	T-1	220/132	250	1093	980	90	930	85	860	79	650	59	810	74	840	77	880	81	920	84	650	59	600	55	760	70	920	84
	220 kV Bandala	T-2	220/132	160	700	675	96	640	91	625	89	565	81	360	51	670	96	540	77	500	71	650	93	545	78	530	76	600	86
	220 kV Bandala	T.3	220/132	160	700	675	96	640	91	625	89	565	81	360	51	670	96	540	77	500	71	560	80	545	78	530	76	600	86
35	220 kV Toba Tekh Singh	T-1	220/132	250	1093	740	68	935	86	875	80	630	58	420	38	370	34	345	32	250	23	645	59	590	54	700	64	715	65
	220 kV Toba Tekh Singh	T-2	220/132	250	1093	740	68	935	86	875	80	630	58	420	38	370	34	345	32	250	23	645	59	590	54	700	64	715	65
	220 kV Toba Tekh Singh	T-3	220/132	160	700	535	76	580	83	525	75	345	49	205	29	265	38	195	28	310	44	415	59	495	71	490	70	460	66
	220 kV Toba Tekh Singh	T-4	220/132	250	1093	860	79	940	86	850	78	570	52	330	30	430	39	320	29	520	48	680	62	840	77	790	72	760	70
36	220 kV Lalian	T-2	220/132	250	1095	Not Existing																						960	88
37	220 kV Bund Road Lhr	T-1	220/132	250	1093	965	88	920	84	750	69	625	57	730	67	220	20	280	26	510	47	460	42	760	70	805	74	840	77
	220 kV Bund Road Lhr	T-2	220/132	250	1093	940	86	860	79	810	74	800	73	580	53	730	67	405	37	510	47	740	68	620	57	805	74	880	81
	220 kV Bund Road Lhr	T-3	220/132	250	1093	965	88	920	84	750	69	625	57	690	63	220	20	280	26	510	47	460	42	760	70	780	71	840	77
	220 kV Bund Road Lhr	T-4	220/132	250	1093	940	86	860	79	810	74	800	73	470	43	730	67	405	37	510	47	740	68	620	57	805	74	880	81
	220 kV Bund Road Lhr	T-5	132/11.5	31.5/40	2008	1640	82	1655	82	1480	74	1370	68	1085	54	980	49	1025	51	1185	59	1245	62	1490	74	1410	70	1510	75
	220 kV Bund Road Lhr	T-6	132/11.5	31.5/40	2008	1290	64	1195	60	1150	57	960	48	610	30	600	30	600	30	1340	67	810	40	1100	55	1385	69	1360	68
38	220 kV Gakkhar	T-1	220/132	160	700	605	86	670	96	560	80	670	96	600	86	570	81	380	54	660	94	600	86	640	91	460	66	560	80
	220 kV Gakkhar	T-2	220/132	160	700	470	67	640	91	510	73	600	86	510	73	630	90	340	49	280	40	520	74	600	86	580	83	620	89
	220 kV Gakkhar	T-3	220/132	160	700	640	91	670	96	600	86	670	96	625	89	595	85	385	55	680	97	620	89	670	96	490	70	580	83
	220 kV Gakkhar	T-4	220/132	160	700	670	96	515	74	560	80	375	54	470	67	330	47	410	59	470	67	480	69	590	84	670	96	640	91
	220 kV Gakkhar	T-5	132/11.5	31.5/40	2008	1710	85	1590	79	1440	72	1210	60	760	38	890	44	765	38	720	36	1010	50	1480	74	1420	71	1830	91
	220 kV Gakkhar	T-6	132/11.5	31.5/40	2008	1350	67	1290	64	1140	57	930	46	750	37	790	39	680	34	650	32	1000	50	1210	60	1300	65	1800	90

Above 80% 70% to 80% Below 70%

S. No.	Name of Grid Station	Auto/Power Transformer	Voltage Level (kV)	Cap.	Cap.	July	July	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	June	June
				(MVA)	(A)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)
39	220 kV Kala Shah Kaku	T-1	220/132	160	700	670	96	690	99	610	87	510	73	550	79	615	88	550	79	660	94	560	80	560	80	580	83	650	93
	220 kV Kala Shah Kaku	T-2	220/132	160	700	670	96	690	99	610	87	510	73	550	79	615	88	550	79	660	94	560	80	560	80	580	83	650	93
	220 kV Kala Shah Kaku	T-3	220/132	160	700	670	96	690	99	610	87	510	73	550	79	580	83	550	79	660	94	560	80	560	80	580	83	650	93
	220 kV Kala Shah Kaku	T-4	220/132	160	700	670	96	690	99	610	87	490	70	550	79	615	88	550	79	660	94	560	80	560	80	580	83	650	93
	220 kV Kala Shah Kaku	T-5	132/11.5	20/26	1305	660	51	625	48	550	42	500	38	470	36	585	45	510	39	465	36	600	46	575	44	670	51	720	55
	220 kV Kala Shah Kaku	T-6	132/11.5	31.5/40	2008	1220	61	1110	55	1050	52	880	44	640	32	750	37	740	37	600	30	900	45	1140	57	1220	61	1290	64
	220 kV Kala Shah Kaku	T-7	132/11.5	31.5/40	2008	735	37	65	3	595	30	440	22	315	16	325	16	685	34	355	18	545	27	560	28	605	30	985	49
40	220 kV New Kot Lakhpat	T-1	220/132	250	1093	1080	99	1060	97	1020	93	845	77	740	68	730	67	690	63	720	66	725	66	1035	95	1060	97	1030	94
	220 kV New Kot Lakhpat	T-2	220/132	250	1093	1080	99	1060	97	1020	93	845	77	740	68	730	67	690	63	720	66	725	66	1035	95	1060	97	1030	94
	220 kV New Kot Lakhpat	T-3	220/132	250	1093	1080	99	1060	97	1020	93	845	77	740	68	730	67	690	63	720	66	725	66	1035	95	1060	97	1030	94
	220 kV New Kot Lakhpat	T-4	132/11.5	31.5/40	2008	1900	95	1920	96	1800	90	1560	78	1290	64	1090	54	1155	58	1600	80	1480	74	1780	89	1900	95	1910	95
	220 kV New Kot Lakhpat	T-5	132/11.5	31.5/40	2008	1750	87	1820	91	1610	80	1490	74	1070	53	1150	57	1270	63	1150	57	1480	74	1690	84	1830	91	1850	92
	220 kV New Kot Lakhpat	T-6	132/11.5	31.5/40	2008	1870	93	1830	91	1830	91	1640	82	1170	58	1005	50	1040	52	1200	60	1530	76	1735	86	1840	92	1900	95
41	220 kV Ravi	T-1	220/132	250	1093	780	71	750	69	730	67	800	73	750	69	350	32	400	37	650	59	520	48	600	55	820	75	710	65
	220 kV Ravi	T-2	220/132	250	1093	780	71	820	75	750	69	700	64	710	65	560	51	460	42	540	49	700	64	740	68	700	64	520	48
	220 kV Ravi	T-3	220/132	250	1093	780	71	820	75	750	69	680	62	740	68	560	51	460	42	650	59	700	64	740	68	700	64	520	48
	220 kV Ravi	T-4	132/11.5	31.5/40	2008	1760	88	1660	83	1530	76	1490	74	1090	54	1120	56	1060	53	1010	50	1120	56	1840	92	1340	67	1470	73
	220 kV Ravi	T-5	132/11.5	31.5/40	2008	1280	64	1380	69	1330	66	1260	63	1090	54	1000	50	990	49	1200	60	1470	73	1570	78	1580	79	1770	88
42	220 kV Sarfaraznagar	T-1	220/132	160	700	700	100	680	97	650	93	540	77	660	94	690	99	520	74	650	93	630	90	660	94	670	96	660	94
	220 kV Sarfaraznagar	T-2	220/132	160	700	700	100	680	97	650	93	540	77	660	94	690	99	520	74	650	93	630	90	660	94	670	96	660	94
	220 kV Sarfaraznagar	T-3	220/132	160	700	700	100	680	97	650	93	540	77	660	94	690	99	520	74	650	93	630	90	660	94	670	96	660	94
	220 kV Sarfaraznagar	T-4	132/11.5	31.5/40	2008	955	48	1130	56	1095	55	1050	52	1140	57	1600	80	1510	75	1355	67	1800	90	1285	64	1510	75	1570	78
	220 kV Sarfaraznagar	T-5	132/11.5	20/26	1305	875	67	620	48	655	50	520	40	550	42	1030	79	1065	82	1030	79	990	76	830	64	870	67	1030	79
	220 kV Sarfaraznagar	T-6	220/132	160	700	700	100	680	97	650	93	540	77	660	94	690	99	520	74	650	93	630	90	660	94	670	96	660	94
43	220 kV Sialkot	T-1	220/132	160	700	530	76	590	84	610	87	380	54	410	59	495	71	375	54	500	71	550	79	550	79	500	71	485	69
	220 kV Sialkot	T-2	220/132	160	700	530	76	590	84	610	87	380	54	410	59	495	71	375	54	500	71	550	79	550	79	500	71	485	69
	220 kV Sialkot	T-3	220/132	160	700	530	76	590	84	525	75	380	54	410	59	470	67	375	54	465	66	550	79	550	79	500	71	485	69
	220 kV Sialkot	T-4	132/11.5	20/26	1305	840	64	845	65	710	54	610	47	400	31	395	30	410	31	680	52	665	51	665	51	830	64	960	74
	220 kV Sialkot	T-5	132/11.5	20/26	1305	860	66	830	64	780	60	690	53	450	34	830	64	575	44	860	66	740	57	740	57	955	73	1180	90
44	220 kV WAPDA Town	T-1	220/132	160	700	700	100	695	99	630	90	590	84	425	61	385	55	625	89	600	86	740	106	560	80	995	142	1025	146
	220 kV WAPDA Town	T-2	220/132	160	700	700	100	695	99	630	90	590	84	425	61	585	84	370	53	430	61	515	74	560	80	690	99	640	91
	220 kV WAPDA Town	T-3	220/132	160	700	700	100	695	99	630	90	590	84	425	61	585	84	370	53	430	61	515	74	560	80	690	99	640	91
	220 kV WAPDA Town	T-4	132/11.5	31.5/40	2008	1600	80	1450	72	1310	65	1080	54	535	27	1020	51	560	28	1100	55	695	35	835	42	1375	68	1740	87
	220 kV WAPDA Town	T-5	132/11.5	31.5/40	2008	1960	98	1970	98	1880	94	1630	81	740	37	750	37	800	40	995	50	1300	65	820	41	1990	99	1980	99
	220 kV WAPDA Town	T-6	132/11.5	31.5/40	2008	1890	94	1960	98	1455	72	1290	64	710	35	700	35	770	38	920	46	1155	58	1430	71	1840	92	1850	92
45	220 kV New Shalamar	T-1	220/132	160	700	470	67	455	65	445	64	300	43	340	49	400	57	340	49	350	50	375	54	335	48	435	62	470	67
	220 kV New Shalamar	T-2	220/132	160	700	470	67	455	65	445	64	300	43	340	49	340	49	340	49	350	50	460	66	335	48	435	62	470	67
	220 kV New Shalamar	T-3	220/132	160	700	470	67	455	65	445	64	300	43	305	44	400	57	340	49	350	50	460	66	335	48	435	62	470	67
46	220 kV Ghazi Lahore	T-1	220/132	250	1093	1000	91	1060	97	895	82	715	65	450	41	560	51	445	41	590	54	490	45	665	61	935	86	1060	97
	220 kV Ghazi Lahore	T-2	220/132	250	1093	965	88	1025	94	865	79	690	63	440	40	560	51	430	39	590	54	490	45	665	61	935	86	1030	94
	220 kV Ghazi Lahore	T-3	220/132	250	1093	965	88	1025	94	865	79	690	63	440	40	560	51	445	41	565	52	490	45	665	61	935	86	1030	94
47	220 kV Gujrat	T-1	220/132	250	1093	600	55	760	70	650	59	500	46	340	31	285	26	260	24	340	31	305	28	450	41	590	54	500	46
	220 kV Gujrat	T-2	220/132	250	1093	560	51	760	70	650	59	500	46	370	34	285	26	260	24	340	31	305	28	450	41	590	54	500	46
	220 kV Gujrat	T-3	220/132	250	1093	600	55	760	70	650	59	485	44	370	34	270	25	260	24	340	31	305	28	450	41	590	54	500	46
48	220 kV Kassowal	T-1	220/132	160	700	710	101	690	99	690	99	670	96	500	71	533	76	554	79	586	84	600	86	518	74	513	73	538	77
	220 kV Kassowal	T-2	220/132	160	700	710	101	690	99	690	99	670	96	500	71	533	76	554	79	586	84	600	86	518	74	513	73	538	77
	220 kV Kassowal	T-4	220/132	250	1093		Not Existing															706	65	835	76	836	76	878	80

Above 80% 70% to 80% Below 70%

S. No.	Name of Grid Station	Auto/Power Transformer	Voltage Level (kV)	Cap.	Cap.	July	July	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	June	June
				(MVA)	(A)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)
49	220 kV Okara	T-1	220/132	250	1093	1070	98	1050	96	960	88	660	60	575	53	645	59	445	41	660	60	775	71	1020	93	1030	94	1040	95
	220 kV Okara	T-2	220/132	250	1093	1070	98	1050	96	960	88	660	60	575	53	645	59	445	41	660	60	775	71	1020	93	1030	94	1040	95
50	220 kV Mardan	T-1	220/132	250	1093	900	82	980	90	870	80	670	61	555	51	710	65	750	69	800	73	660	60	670	61	745	68	860	79
	220 kV Mardan	T-2	220/132	250	1093	950	87	980	90	870	80	670	61	555	51	710	65	750	69	910	83	660	60	670	61	745	68	860	79
	220 kV Mardan	T-3	220/132	250	1093	950	87	950	87	870	80	670	61	555	51	710	65	660	60	910	83	660	60	670	61	745	68	860	79
	220 kV Mardan	T-4	132/11	40	2008	1295	64	1930	96	1840	92	1670	83	1390	69	1735	86	1460	73	990	49	1310	65	1390	69	1690	84	1850	92
	220 kV Mardan	T-5	132/11	40	2008	1920	96	1295	64	1285	64	1255	63	935	47	1045	52	975	49	955	48	1175	59	1330	66	1490	74	1640	82
51	220 kV Burhan	T-1	220/132	250	1093	910	83	970	89	840	77	710	65	600	55	580	53	590	54	570	52	560	51	630	58	700	64	790	72
	220 kV Burhan	T-2	220/132	250	1093	910	83	970	89	840	77	710	65	600	55	580	53	590	54	570	52	560	51	630	58	700	64	790	72
	220 kV Burhan	T-3	220/132	250	1093	910	83	970	89	840	77	710	65	600	55	580	53	590	54	570	52	560	51	630	58	700	64	790	72
	220 kV Burhan	T-4	220/132	250	1093	910	83	970	89	840	77	710	65	600	55	580	53	590	54	570	52	560	51	630	58	700	64	790	72
	220 kV Burhan	T-5	132/11	10/13	653	280	43	350	54	285	44	265	41	265	41	365	56	360	55	365	56	365	56	365	56	380	58	380	58
52	220 kV Daudkhel	T-1	220/132	160	700	675	96	698	100	640	91	536	77	393	56	640	91	582	83	606	87	630	90	626	89	664	95	682	97
	220 kV Daudkhel	T-2	220/132	160	700	675	96	698	100	640	91	606	87	393	56	640	91	582	83	606	87	630	90	626	89	664	95	682	97
	220 kV Daudkhel	T-3	132/11	10/13	653	161	25	161	25	141	22	131	20	91	14	71	11	71	11	71	11	101	15	151	23	151	23	161	25
53	220 kV Bannu	T-1	220/132	160	700	600	86	640	91	560	80	460	66	530	76	520	74	560	80	560	80	440	63	600	86	540	77	570	81
	220 kV Bannu	T-2	220/132	160	700	600	86	640	91	560	80	460	66	530	76	520	74	560	80	560	80	440	63	600	86	540	77	570	81
	220 kV Bannu	T-5	220/132	250	1093	860	79	680	62	540	49	730	67	740	68	1055	97	700	64	740	68	720	66	660	60	800	73	620	57
	220 kV Bannu	T-3	132/11	20/26	1305	1300	100	1280	98	1280	98	1280	98	1290	99	1280	98	1200	92	1270	97	1220	93	1270	97	1280	98	1290	99
	220 kV Bannu	T-4	132/11	40	2008	1740	87	1440	72	1320	66	1280	64	1400	70	1580	79	1320	66	1460	73	1460	73	1770	88	1640	82	1510	75
54	220 kV ISPR (Sangjani)	T-1	220/132	160	700	640	91	610	87	540	77	450	64	320	46	340	49	380	54	400	57	520	74	490	70	515	74	600	86
	220 kV ISPR (Sangjani)	T-2	220/132	160	700	640	91	610	87	540	77	450	64	320	46	340	49	380	54	400	57	505	72	490	70	515	74	600	86
	220 kV ISPR (Sangjani)	T-3	220/132	160	700	680	97	660	94	520	74	440	63	300	43	320	46	410	59	375	54	560	80	550	79	580	83	670	96
	220 kV ISPR (Sangjani)	T-4	220/132	160	700	680	97	660	94	520	74	440	63	300	43	320	46	410	59	375	54	560	80	550	79	580	83	670	96
	220 kV ISPR (Sangjani)	T-7	220/132	160	700	Not Existing																		440	63	580	83	670	96
	220 kV ISPR (Sangjani)	T-5	132/11	20/26	1305	860	66	825	63	860	66	730	56	510	39	685	52	610	47	510	39	660	51	810	62	870	67	1080	83
	220 kV ISPR (Sangjani)	T-6	132/11	10/13	653	390	60	415	64	385	59	330	51	255	39	225	34	210	32	255	39	245	38	325	50	375	57	415	64
55	220 kV University Isb	T-1	220/132	250	1093	1100	101	1080	99	940	86	880	81	830	76	980	90	570	52	555	51	375	34	750	69	815	75	935	86
	220 kV University Isb	T-2	220/132	250	1093	1080	99	1050	96	880	81	890	81	635	58	685	63	525	48	555	51	390	36	715	65	805	74	880	81
	220 kV University Isb	T-4	132/11	40	2008	1275	63	1265	63	1050	52	850	42	610	30	650	32	625	31	595	30	775	39	970	48	1095	55	1325	66
	220 kV University Isb	T-5	132/11	20/26	1305	555	43	570	44	635	49	440	34	590	45	405	31	330	25	320	25	365	28	480	37	595	46	785	60
56	220 kV Shahibagh	T-1	220/132	160	700	350	50	330	47	350	50	280	40	260	37	335	48	250	36	240	34	387	55	330	47	250	36	330	47
	220 kV Shahibagh	T-2	220/132	160	700	350	50	330	47	350	50	280	40	260	37	335	48	250	36	240	34	387	55	330	47	280	40	330	47
	220 kV Shahibagh	T-3	220/132	160	700	350	50	330	47	350	50	280	40	260	37	335	48	250	36	240	34	387	55	330	47	280	40	330	47
	220 kV Shahibagh	T-4	220/132	160	700	350	50	330	47	350	50	280	40	260	37	335	48	250	36	240	34	387	55	330	47	280	40	330	47
	220 kV Shahibagh	T-5	132/11	10/13	653	632	97	612	94	622	95	562	86	492	75	552	85	572	88	532	81	462	71	592	91	602	92	632	97
	220 kV Shahibagh	T-6	132/11	10/13	653	642	98	622	95	612	94	542	83	472	72	544	83	542	83	452	69	472	72	542	83	592	91	522	80
57	220 kV Mansehra	T-1	220/132	250	1093	600	55	650	59	600	55	510	47	570	52	600	55	590	54	640	59	540	49	310	28	360	33	490	45
	220 kV Mansehra	T-2	220/132	250	1093	600	55	650	59	600	55	510	47	940	86	600	55	590	54	640	59	540	49	310	28	360	33	490	45
	220 kV Mansehra	T-3	132/11	10/13	653	3.5	1	3.2	0	3.2	0	3.2	0	3.5	1	4.2	1	4.1	1	4.1	1	4	1	3.6	1	3.9	1	3.9	1
58	220 kV Chakdara	T-1	220/132	250	1093	760	70	750	69	650	59	560	51	730	67	770	70	680	62	730	67	640	59	600	55	600	55	670	61
	220 kV Chakdara	T-2	220/132	250	1093	760	70	750	69	650	59	560	51	730	67	770	70	680	62	730	67	640	59	600	55	600	55	670	61
	220 kV Chakdara	T-3	132/11	10/13	653	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0
59	220 kV D.I. Khan	T-1	220/132	250	1093	555	51	583	53	520	48	440	40	442	40	735	67	450	41	450	41	468	43	630	58	430	39	365	33
	220 kV D.I. Khan	T-2	220/132	250	1093	555	51	583	53	520	48	440	40	442	40	735	67	450	41	450	41	468	43	630	58	430	39	365	33
	220 kV D.I. Khan	T-3	132/11	10/13	653	9.6	1	8.9	1	7.5	1	6.3	1	4.1	1	5.1	1	4.8	1	5	1	6	1	6.7	1	8.3	1	9.9	2

Above 80% 70% to 80% Below 70%

S. No.	Name of Grid Station	Auto/Power Transformer	Voltage Level (kV)	Cap.	Cap.	July	July	Aug	Aug	Sep	Sep	Oct	Oct	Nov	Nov	Dec	Dec	Jan	Jan	Feb	Feb	Mar	Mar	Apr	Apr	May	May	June	June
				(MVA)	(A)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)	(A)	(%)
60	220 kV Nowshera	T-1	220/132	250	1093	510	47	470	43	370	34	280	26	290	27	520	48	450	41	450	41	450	41	830	76	620	57	640	59
	220 kV Nowshera	T-2	220/132	250	1093	510	47	470	43	370	34	280	26	380	35	520	48	670	61	450	41	450	41	830	76	620	57	640	59
	220 kV Nowshera	T-3	132/11	10/13	653	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1	5	1
64	220 kV Muzaffargarh	T-1	220/132	160	700	605	86	540	77	590	84	375	54	545	78	465	66	310	44	400	57	430	61	510	73	550	79	555	79
	220 kV Muzaffargarh	T-2	220/132	160	700	605	86	540	77	590	84	375	54	545	78	465	66	500	71	400	57	430	61	510	73	550	79	555	79
	220 kV Muzaffargarh	T-4	220/132	160	700	485	69	540	77	465	66	375	54	460	66	300	43	420	60	400	57	415	59	510	73	550	79	555	79
62	220 kV Bahawalpur	T-1	220/132	160	700	670	96	627	90	522	75	413	59	512	73	390	56	273	39	338	48	362	52	602	86	626	89	496	71
	220 kV Bahawalpur	T-2	220/132	250	1093	904	83	880	81	845	77	684	63	472	43	711	65	790	72	514	47	558	51	860	79	975	89	900	82
	220 kV Bahawalpur	T-3	220/132	250	1093	904	83	880	81	940	86	684	63	472	43	867	79	700	64	514	47	820	75	860	79	975	89	900	82
	220 kV Bahawalpur	T-4	132/11	20/26	1305	1093	84	1035	79	978	75	633	49	652	50	575	44	592	45	610	47	805	62	1130	87	1095	84	1208	93
63	220 kV Lal Sohanra	T-1	220/132	250	1093	760	70	720	66	690	63	625	57	350	32	360	33	390	36	440	40	480	44	720	66	750	69	700	64
64	220 kV Chishtian	T-1	220/132	160	700	690	99	685	98	666	95	625	89	375	54	462	66	286	41	340	49	465	66	630	90	665	95	583	83
	220 kV Chishtian	T-2	220/132	160	700	690	99	685	98	666	95	620	89	412	59	510	73	286	41	340	49	465	66	630	90	665	95	583	83
	220 kV Chishtian	T-4	220/132	160	700	Not Existing														258	37	465	66	548	78	621	89	583	83
65	220 kV Vehari	T-1	220/132	125/160	700	690	99	680	97	625	89	620	89	490	70	300	43	440	63	565	81	505	72	690	99	645	92	645	92
	220 kV Vehari	T-2	220/132	125/160	700	690	99	680	97	625	89	980	140	490	70	300	43	440	63	565	81	505	72	690	99	645	92	645	92
	220 kV Vehari	T-3	220/132	250	1093	1040	95	1050	96	970	89	562	51	630	58	500	46	590	54	800	73	905	83	1040	95	1050	96	830	76
	220 kV Vehari	T-4	132/11.5	20/26	1305	692	53	752	58	642	49	740	57	577	44	392	30	357	27	372	29	422	32	812	62	1017	78	932	71
	220 kV Vehari	T-5	132/11.5	20/26	1305	980	75	1080	83	945	72	550	42	500	38	620	48	540	41	842	65	710	54	1055	81	1005	77	1060	81
66	220 kV NGPS	T-1	220/132	160	700	681	97	664	95	700	100	660	94	481	69	520	74	492	70	520	74	665	95	685	98	675	96	610	87
	220 kV NGPS	T-5	220/132	160	700	681	97	664	95	700	100	660	94	481	69	520	74	460	66	520	74	665	95	685	98	640	91	610	87
	220 kV NGPS	T-3	220/132	160	700	Not Existing																						610	87

Above 80% 70% to 80% Below 70%

NATIONAL ELECTRIC POWER
REGULATORY AUTHORITY

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